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Monitoring Chlorpyrifos & Diazinon in Impaired Surface Waters of the Lower Salinas Region: Status Report No. 2

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Preface

This document will eventually be the final report of a project involving the monitoring of chlorpyrifos and diazinon in impaired surface waters of the lower Salinas region, Monterey County, California. This version is limited to a status report including the project background, aims and general methodology, previous work, description of the study area and summary of data collected to date. Some data necessary for a full analysis of the summer 2002 ambient monitoring period was not yet available at the time of report submittal. All data is subject to further validation.

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1 Introduction

1.1 Background

A number of water bodies in the region surrounding Monterey Bay are listed as impaired due to ‘pesticides’ under Section 303(d) of the Clean Water Act. Total maximum daily loads (TMDLs) must be developed for these water bodies. As explained below, the proposed work focuses on two currently applied organophosphate pesticides: chlorpyrifos and diazinon.

Regional data are available on the timing and location of pesticide application (California Department of Pesticide Regulation (CDPR), 2001), on concentrations observed downstream in water, sediment, and tissue (detailed in Section 1.4); and on the toxicity of aquatic organisms due to pesticides (Hunt et al., 1999; publication pending). But a thorough analysis of the linkage between application data and later occurrence of pesticides in waterways is lacking. In particular, the spatial and temporal dynamics of pesticide transport in the region are poorly understood.

Of the currently used pesticides, chlorpyrifos and diazinon have been identified as being responsible for toxicity of crustaceans in a number of stream water samples (Siepmann and Finlayson, 2000; Hunt, publication pending) and are present in biologically effective quantities in sediments and tissues (Section 1.4). Their concentration in streams exceeds levels that are known to impact the life cycles of higher organisms such as the federally threatened South Central Coast evolutionary significant unit (ESU) steelhead trout. 59,742 kg of diazinon and 42,408 kg of chlorpyrifos were applied in hydrologic unit 309 (Salinas Valley) in 1999, and concentrations of above 1 μg/L (in water) and 1 μg/kg (sediment) have been measured in waterways. Transport and transformation between the two appears to be highly dependent on intermittent peak stream flow, and originates from geographically disparate sources.

1.2 Chlorpyrifos and Diazinon

Chlorpyrifos is relatively insoluble in water (0.733 mg/L @ 20ºC), adsorbs strongly to soil organic matter (soil absorption coefficient (K_{oc}) 5300 to 14800), and is moderately volatile (vapor pressure 2.3 millipascals (mPa) @ 20ºC) (Azimi-Gaylon et. al., 2001). Its environmental fate is dominated by hydrolysis and microbial degradation. Half-lives range from 7 to 56 days for soil and surface applications to 12 to 52 days in sediment/water systems (Montgomery, 1997). The lethal concentration that kills 50% of individuals tested (LC_{50}) for rainbow trout is 3 parts per billion (ppb) (Montgomery, 1997); *Ceriodaphnia dubia* (water flea) is 53 parts per trillion (ppt) (Hunt, publication pending).

Diazinon is moderately soluble in water (60 mg/L @ 20ºC), does not readily adsorb to soil organic matter (K_{oc} 1007 to 1842), and is moderately volatile (0.64 mPA @ 20ºC) (Azimi-Gaylon et. al., 2001). Its environmental fate is also dominated by hydrolysis and microbial degradation. Half-lives range from 14 to 194 days for soil and surface applications to 8 to 10 days in estuarine water (Montgomery, 1997). The LC_{50} for rainbow trout is 16 parts per million (ppm) (Montgomery, 1997); *C. dubia* is 320 ppt (Hunt, publication pending).

The criterion maximum concentration (CMC) and criterion continuous concentration (CCC) are guidelines most commonly used in California to relate short-term and long-term environmental exposure of these pesticides. The CMC for chlorpyrifos is 20 ppt; CCC is 14 ppt. The CMC for diazinon is 80 ppt; CCC 50 ppt (Siepmann and Finlayson, 2000).

1.3 Aims & general methodology

This study aims to clarify the links between application of chlorpyrifos and diazinon and their appearance in 303(d)-listed water bodies by monitoring the movement of these chemicals in listed water bodies, and the mechanisms by which they are moved.

The following questions will be answered:

- Are concentrations of chlorpyrifos and diazinon above levels that limit aquatic ecosystem health?
- What is the variability of *in situ* sediment chlorpyrifos and diazinon concentration and load during ambient non-winter conditions?
- Is it possible to measure loads of chlorpyrifos and diazinon that explain this variability?
- Are loads significant during ambient non-winter conditions?
- Are loads significant during winter events?
- Is there evidence that urban loads are significant?
- Is there evidence that agricultural loads are significant?
- Are the data consistent with published half-lives?

- Is aqueous transport of chlorpyrifos and diazinon significant?
- Is adsorbed transport of chlorpyrifos and diazinon significant?
- Is there a relationship between total suspended solids and transport of chlorpyrifos and diazinon?

Samples will be taken both within listed water bodies, their sediments, and the flows into these water bodies. A dual focus on both ambient and event-based sampling will be used. Ambient sampling will be done to establish baseline spatial patterns and potential 'hot spots'. Event-based sampling will then be done both in response to summer irrigation and winter rainfall events in an attempt to identify the most important dynamics of chlorpyrifos and diazinon delivery to receiving waters. This will include analysis of flow and sediment concentration covariates.

We anticipate that there will be significant spatial, temporal, and matrix variation in chlorpyrifos and diazinon concentrations and loads. Spatial variation is expected due to different application, transport regimes, and degradation regimes in the seven quite different listed water bodies. Temporal variation is expected for the same reasons, and also because of the differing flow regimes of in-growing-season (summer) and out-of-growing-season (winter) flows. We expect to find a relationship between storm hydrograph peaks and pesticide levels in situations when storms overlap, or almost overlap with the growing season. Finally, we expect matrix variation due to other substances present in samples. In particular, we expect a correlation between pesticide concentrations and fine sediment concentration. If this is the case, there are significant implications for the expectation of pollutants adsorbed to any loads of fine sediment observed in the region.

1.4 Previous Work

Previous studies, monitoring and/or data of pesticides in the 303(d) listed water bodies in the lower Salinas region include:

- State Mussel Watch Program (SMW): www.swrcb.ca.gov/programs/smw
    - 3 reports: State Water Resources Control Board (SWRCB), 1994, 1996, 2000
- Toxic Substances Monitoring Program (TSM): www.swrcb.ca.gov/programs/smw
    - 3 reports: SWRCB, 1993, 1995a, 1995b

- Chemical and Biological Measures of Sediment Quality in the Central Coast Region (SWRCB et al., 1998): a.k.a. Bay Protection and Toxic Cleanup Program (BPTC)
- Central Coast Ambient Monitoring Program (CCAMP): http://www.ccamp.org/
- Temporal Distribution of Insecticide Residues in Four California Rivers (DPR, 1997): http://www.cdpr.ca.gov/
- United States Geological Survey (USGS) water quality data: http://waterdata.usgs.gov/nwis/qwdata&introduction

The data from SMP, TSM and CCAMP are available online from CCAMP. Databases for SMP and TSM are also available at: www.swrcb.ca.gov/programs/smw. Department of Pesticide Regulation data are available at the above CDPR website.

Previous data on sediment and water concentrations of chlorpyrifos and diazinon found to date at regional sites are summarized in Appendix 1, Table 1. Limited information on chlorpyrifos and diazinon emerged from these studies. For instance, data from the SMW and TSM were primarily the result of tissue sampling and not reported in Appendix 1. CCAMP and BPTC examined chlorpyrifos and diazinon in sediments at a few locations in the region, but the data were very limited as sampling was not conducted on a regular basis. Although general water quality data (including pesticide) collected by federal sources such as the USGS exist for multiple Salinas River sites, none are available for sampling sites of this study. No studies have been found to date that address the spatial and temporal variation of chlorpyrifos and diazinon loads for this study area. Appendix 1, Table 1 shows that chlorpyrifos was examined for (in water and sediment) 120 times for all data combined and was detected 18 times; once in water (110 ppt) and 17 times in sediment (average = 4,558 ppt, coefficient of variance (CV) = 107%). Diazinon was examined for (in water and sediment) 204 times for all data combined and was detected 26 times; 16 in water (average=33 ppt, CV=150%) and 10 times in sediment (average = 4,540 ppt, CV= 32%).

2 Study Area

2.1 Study Area Description

The study area for this project is located in the lower Salinas Valley of Monterey County, California (Chapter 2, Fig. 1). A total of nine study sites (Chapter 2, Table 1) are located within a system of interconnected rivers, creeks, ditches, sloughs, and lagoons draining into the Monterey Bay National Marine Sanctuary via the Old Salinas River through Moss Landing Harbor and the Salinas River flowing directly to the Pacific Ocean.

All of the nine locations are 303(d) listed water bodies for pesticides and are loosely classified as either 'flux' or 'receiving' sites (Chapter 2, Table 1). 'Flux' sites are located on waterways which generally have continuous flow and are therefore capable of transporting pollutants such as chlorpyrifos and diazinon, either dissolved in the water column or adhered to suspended sediment particles. 'Receiving' sites are located in settling areas, where water velocities are typically lower and much of the suspended sediment has settled out the water column into the benthos.

Table 1. Pesticide Monitoring Sites

Site #	Waterway	Location	Site Code	Type
1	Salinas River	Davis Rd.	SAL-DAV	Flux
2	Salinas Lagoon	Del Monte Rd.	SAL-MON	Receiving
3	Blanco Drain	Cooper Rd.	BLA-COO	Flux
4	Blanco Drain	Pump-out station	BLA-PUM	Receiving
5	Reclamation Ditch	San Jon Rd.	REC-JON	Flux
6	Old Salinas River	Potrero Rd.	OLS-POT	Flux
7	Moss Landing Harbor	Sandholdt Rd.	MOS-SAN	Receiving
8	Espinosa Slough	Rogers Rd.	EP1-ROG	Flux
9	Espinosa Slough	NE end of lake	EPL-EPL	Receiving

North Salinas Valley Pesticide Monitoring Sites

Including

Salinas River, Salinas Lagoon, Blanco Drain, Reclamation Ditch, Espinosa Slough, Old Salinas River Channel, and Moss Landing Harbor

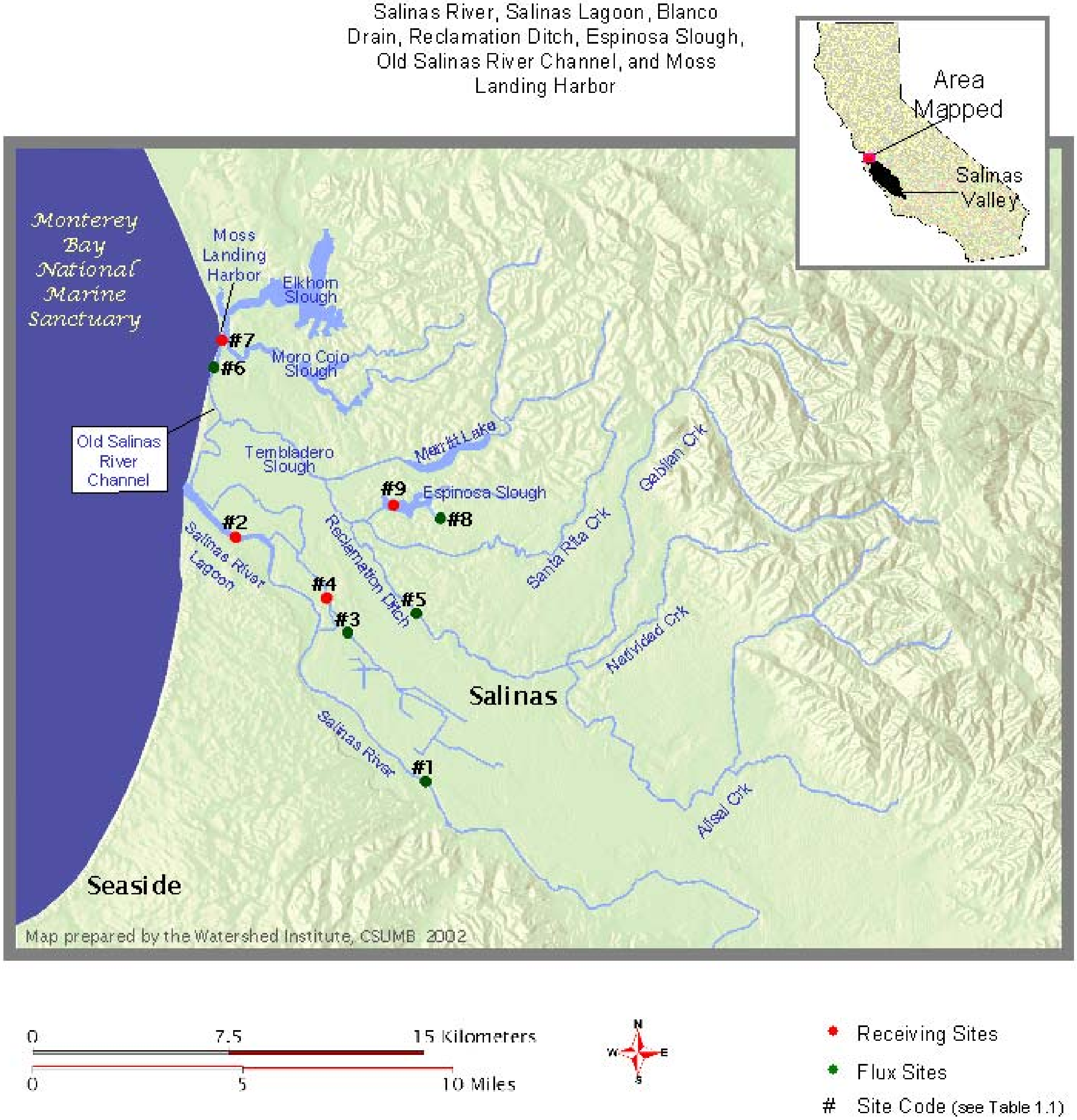

Figure 1. Map of North Salinas Valley showing study area and pesticide monitoring sites.

2.2 Site Descriptions

Site #1

Site 1 (Chapter 2, Fig. 2) is located on a perennial reach of the Salinas River at the Davis Road crossing, approximately 14 km upstream from Site #2. Site 2 is an ideal location to measure the majority of loads delivered by the Salinas River to receiving waters such as the Salinas Lagoon and the Pacific Ocean. This location could potentially exhibit significant pollutant transport under certain conditions. It also provides *in situ* habitat for species such as the federally threatened steelhead, other native fish of the Salinas River, waterfowl, and other aquatic organisms.

The low flow channel is approximately 5 m wide with sand as the dominant substrate. The main channel ranges from approximately 100 to 200 m wide. Riparian vegetation is abundant and the surrounding land use is primarily row-crop agriculture.

Figure 2. Site #1-Salinas River looking upstream from Davis Rd. (Photo: Don Kozlowski, June 2002)

Site #2

Site 2 (Chapter 2, Fig.3) is located on the Salinas Lagoon at Del Monte Road, less than 3 km upstream from the mouth with Pacific Ocean. This location receives all the flow and loads of pollutants from the Salinas River as well as some from Site #4 (Blanco Drain). The Salinas Lagoon supports several unique threatened and endangered species including: Menzies Wallflower, Slender-Flowered Gilia, Smith's Blue Butterfly and its host-Coastal Buckwheat, snowy plover, black legless lizard, dune beetle, and south-central coast Steelhead.

The channel is much wider than at Site 1, and the substrate has a higher percentage of silt and clay. Riparian vegetation is less abundant than at Site 1, and the adjacent land use is predominantly row-crop agriculture with some residential and recreational land use.

During winter storm events, flow from the Salinas River will fill this lagoon until it breaches or is breached by the Monterey County Water Resources Agency, sending pollutants directly to the ocean. Otherwise, flow is directed from the lagoon down the Old Salinas River Channel to Moss Landing Harbor via the Potrero tide gates.

Figure 3. Site #2-Salinas Lagoon looking upstream from Del Monte Rd. (Photo: Don Kozlowski, June 2002)

Site #3

Site 3 (Chapter 2, Fig. 4) is found on the channelized system known as Blanco Drain, one of the more polluted areas according to data from the State Mussel Watch Program. It is located at the Cooper Road crossing, approximately 1.5 km upstream of the receiving area of the Blanco Drain pump station (Site #4). This makes it an ideal site to monitor for pesticide flux contributed by the adjacent land use, row-crop agriculture. Historically a freshwater wetland, the system was channelized to drain storm and agricultural runoff. The drainage originates just south of the city of Salinas and flows north approximately parallel to the Salinas River. Blanco Drain lacks riparian vegetation and is comprised of a predominantly silt/clay substrate.

Figure 4. Site #3-Blanco Drain looking upstream from Cooper Rd. (Photo: Don Kozlowski, June 2002)

Site #4

Site 4 (Chapter 2, Fig. 5) is located on the Blanco Drain, approximately 1.5 km downstream of Site 3, and immediately upstream from the pump-out station. Blanco Drain flows to the pump-out station where water is impounded (left side of Fig. 5) and then pumped into the Salinas River (less than 0.5 km to the west) via a connecting channel (right side of Fig. 5). This monitoring location serves as an area of low water flow where sediments settle. The adjacent land use is row-crop agriculture.

Figure 5. Site #4-Blanco Drain looking upstream (left) from pump-out station and downstream (right) to the Salinas River. (Photo: Don Kozlowski, June 2002)

Site #5

Site 5 (Chapter 2, Fig. 6) is located on the Reclamation Ditch at San Jon Road. It is approximately 12 km upstream from the confluence of Tembladero Slough and the Old Salinas River channel and approximately 5 km downstream from the city of Salinas. The Reclamation Ditch originates near Carr Lake in Salinas and captures the drainages of Gabilan, Natividad, and Alisal creeks. The Reclamation Ditch was constructed in 1917 to route waters from Salinas and nearby agricultural fields into Tembladero Slough and finally into Moss Landing Harbor through the Potrero tide gates. Site 5 therefore serves as a good 'flux' site for monitoring pesticides from the city and some agriculture on the way to those gates. The Ditch is channelized, lacks riparian vegetation, and the primary substrate is silt/clay. Adjacent land use at this site is row-crop agriculture. This site is also the past and future location of a United States Geological Survey gauging station.

Figure 6. Site #5-Reclamation Ditch looking upstream from San Jon Rd. (Photo: Don Kozlowski, June 2002)

Site #6

Site 6 (Chapter 2, Fig. 7) is located on the Old Salinas River channel at the Potrero Road, approximately 14 km downstream of Site 5. This location serves as a 'flux' site for the study as flow from the channel is directed through the Potrero tide gates. However, the gates tend to slow the flow enough to widen the channel, allowing sediments to drop to the benthos. In this respect, it is also a 'receiving' site. This site will have pollutant contributions from all other upstream sites. The channel has a predominantly silt/clay substrate and lacks significant riparian vegetation. The adjacent land use is mainly row-crop agriculture with some recreational land use.

Figure 7. Site #6-Old Salinas River looking upstream from Potrero Rd. (Photo: Don Kozlowski, June 2002)

Site #7

Site 7 (Chapter 2, Fig. 8) is located in Moss Landing Harbor at the Sandholdt Road crossing, approximately 1 km downstream of Site 6. This site is the 'receiving' location for flow from the Old Salinas River channel and Tembladero Slough. Being connected to the ocean, it is significantly influenced by the tide. Contribution of pesticide pollution from the Old Salinas River Channel to Elkhorn Slough is largely dependant upon flows past this site and tidal dynamics, in this respect making it a 'flux' site, also. The channel is broad and lacks riparian vegetation, but has abundant tidal marsh vegetation. The primary substrate is silt/clay with some riprap.

Figure 8. Site #7-Moss Landing Harbor looking downstream from Potrero Rd. (Photo: Joel Casagrande)

Site #8

Site 8 (Chapter 2, Fig. 9), a 'flux' site, is located on an upstream tributary to Espinosa Lake at the Rodgers Road crossing. The drainage originates northeast of the city of Salinas, flows into Espinosa Lake, and if necessary is pumped into the Reclamation Ditch for flood control. This channelized arm of Espinosa Slough is an agricultural ditch, approximately 1 to 2 m wide, and a major contributor of Espinosa Lake's water. The channel lacks riparian vegetation and the dominant substrate is silt/clay. Adjacent land use is row-crop agriculture. There is significant contribution of water flow from upstream greenhouses.

Figure 9. Site #8-Espinosa Slough looking upstream from Rodgers Rd. (Photo: Don Kozlowski, June 2002)

Site #9

Site 9 (Chapter 2, Fig. 10) is located in the middle of Espinosa Lake, approximately 2 km west of Site 8. This location will serve as a 'receiving' site for the study and will be accessed via kayak. The lake has limited riparian vegetation and the adjacent land uses are row-crop agriculture, grazing, and residential. In the event of flooding, Espinosa lake is drained by a pump sending water into the Reclamation Ditch.

Figure 10. Site #9-Espinosa Lake looking east. (Photo: Don Kozlowski, June 2002)

3 Methods

3.1 Sample Collection

The nine sites were sampled according to the schedule in Appendix 1, Table 2 for summer 2002 ambient level monitoring. A total of 55 water samples, 44 suspended solids (SS) samples, and 54 benthic samples were collected and analyzed. Each site was visited within a 24 hr period for each of the five sampling events or "runs". During the July sampling run, one SS sample (BLA-COO) and one benthic duplicate (SAL-MON) were not obtained. All samples were collected and analyzed according to CCoWS protocols (Watson et. al., 2002), with the exception of samples sent to an external laboratory. One water and one benthic sample from a particular site during each sampling run was sent to Agricultural & Priority Pollutants Laboratories (APPL), Inc., for comparative analysis (Appendix 1, Table 2). CCoWS sample collection and laboratory methods are detailed in the CCoWS protocols document, Sections 4.7 and 5.4. General protocols are addressed below.

At each site, sample water was pumped *in situ* through a 0.7 micron glass-fiber filter and collected into an amber glass bottle. Duplicate water samples (1 per sampling run, 5 total) as well as those collected for external laboratory analysis (1 per sampling run, 5 total) were obtained in the same manner and collected sequentially. The filter with particulate (SS sample) was then pressed to remove excess water and placed into an amber glass jar. Benthic samples were obtained using a benthic sediment sampling dredge or a Teflon sampling scoop and were then placed into a stainless steel bowl and mixed with a stainless steel spoon. An aliquot of this mixture was placed into an amber glass jar, with duplicates (1 per sampling run, 4 total) and outside laboratory samples (1 per sampling run, 5 total) obtained from the same mixture.

Total suspended solids (TSS) samples were obtained using a DH-48 integrated sediment sampler. All samples were immediately placed in a cooler and transported to the CCoWS laboratory where they were refrigerated at 4°C until analysis. Water velocity was measured either with an impellor-type current meter or by timing a surface float over a measured distance. During the July and October ambient runs, several additional water quality parameters were measured at each site using a YSI 556 Multi-Probe System.

3.2 Laboratory Methods

3.2.1 CCoWS

Water samples were processed in the CCoWS laboratory using Enzyme Linked Immuno-Sorbent Assay (ELISA) technology according to manufacturer and State Water Resource Control Board (SWRCB) instructions (Katznelson and Feng, 1998). Standard curves based upon the calibrator pairs used for these analysis give an estimated detection limit (EDL) of 63 ng/L (parts per trillion or ppt) for chlorpyrifos and 25 ng/L (ppt) for diazinon.

Particulate matter captured on the field filter was wet-weighed, dehydrated, dry-weighed and then extracted with methanol. The methanol extract was then analyzed using ELISA techniques. The EDL for this procedure varies with the amount of sample obtained and the amount of methanol used for extraction and is highly variable. On average, the EDLs for chlorpyrifos were approximately 16,000 ng/kg (ppt) for the July run (CV=93%), 23,000 ppt for the August run (CV=52%), and 47,000 ppt for all other runs (CV=72%). The EDLs for diazinon were 6,400, 9,200, and 18,800 ppt for the same respective runs with the same CVs. The progressively larger EDLs for the runs result from using increased amounts of methanol in the extraction process.

Benthic sediment pesticide concentrations are reported in amount of pesticide to dry weight of sediment (ng/kg). Benthic samples were split into two portions. A smaller portion was wet-weighed, oven dried, then re-weighed to determine wet-to-dry weight ratio. For the October run samples, this portion was also used to characterize the % silt/clay component of the benthic samples. This was accomplished by wet sieving the sample through a 63 micron sieve, drying, and reweighing the remaining sand component. The remaining portion of the benthic sample had overlying water decanted, was extracted with methanol and analyzed with ELISA. The EDLs for benthic samples are also variable and dependent upon sample mass and methanol volume. However, methanol volumes for benthic extractions were not modified throughout the runs. The average EDL for chlorpyrifos benthic samples was approximately 3,600 ppt (CV=42%); diazinon, 1,500 ppt (CV=42%).

Total suspended solids (TSS) samples were vacuum filtered through a 63 micron sieve. The portion >63 microns was transferred to a glass fiber filter, dried and weighed to determine the sand component. The remaining sample was filtered through a 1.5 micron glass fiber filter, dried and weighed to determine the silt/clay component. Sample volume was determined by dividing the weight of the water in the sample by the density of water. Results were reported as mg/L.

3.2.2 APPL, Inc.

APPL used EPA 8141A analysis for the detection of organophosphate (OP) pesticides in water and soil samples sent by CCoWS. This gas chromatography (GC) method detects 30 different OP pesticides at various practical quantitative limits (PQLs) as reported by APPL. For chlorpyrifos and diazinon, these PQLs are 50 ppt (similar to CCoWS 63 ppt) for water samples and 50 ppb (much higher than CCoWS approximate 2.5 ppb) for soil samples.

3.3 Quality Assurance/Quality Control (QA/QC)

Various measures were instituted to ascertain and assure the accuracy, variability and reliability of data obtained from the samples collected. These included the use of:

- field method blanks
- laboratory method blanks
- laboratory-fortified matrices (spikes)
- controls, replicates, duplicates
- analysis of split samples by an external laboratory.

3.3.1 Field Method Blanks

Field method blanks are used to assess contamination potential. Sampling equipment was cleaned according to protocols after sampling at each site. Following sampling of the final site of a sampling run, deionized water was run through field-cleaned equipment and collected in sample bottles/jars. They were then placed in the cooler with other samples and analyzed for target analytes. Level of contamination of the sample due to multiple factors (i.e. sample jars, filters, sampling equipment, collection technique and storage/transportation) was assessed.

3.3.2 Lab Method Blanks

Laboratory method blanks assess potential contamination of laboratory reagents and equipment. High Performance Liquid Chromatography (HPLC) water and methanol used in the processing of samples were tested for contamination during the first and last sampling runs.

3.3.3 Laboratory-Fortified Matrices (Spikes)

Laboratory-fortified matrices (spikes) are samples that have a known concentration of analyte added prior to processing in order to evaluate analyte recovery. Twelve environmental samples of various matrices were spiked with the control standards for chlorpyrifos and diazinon by mixing the sample with an equal volume of control standard then analyzed using ELISA. Recovery is a percentage determined by dividing the value obtained by the value expected. The value expected is the mean of the sample value and the control value. At least one control per sampling run was analyzed for each analyte during both water and sediment analysis.

3.3.4 Controls, Replicates and Duplicates

Controls are standards prepared from stock concentrations of analyte. They are diluted to a specific concentration and used to help determine the accuracy of the test. Controls are analyzed along with environmental samples. At least one control was analyzed for both analytes during water and sediment analysis for all sampling runs.

Replicates are the same sample analyzed more than once in order to indicate variance of the analytical procedure. Replicate values may be from the same analysis batch, a different analysis batch, or determined from dilutions of the sample from any batch.

Duplicates are derived from homogenized sample splits taken in the field from the same location at the same time. They are used to indicate variability between like samples, can give some indication of contamination, and in this study were also used to compare inter-laboratory/inter-analysis method variation.

3.3.5 Inter-Laboratory/Inter-Analysis Method Comparisons

One benthic and one filtered water duplicate sample from a pre-chosen location was sent to Agricultural & Priority Pollutants Laboratories (APPL), Inc for EPA 8141A gas chromatography (GC) analysis immediately following each sampling run. A total of 20 samples were sent for GC analysis for the detection of organophosphates.

3.4 Data Analysis/Calculations

Reported chlorpyrifos and diazinon concentrations for any sample may have been obtained by an average value of the following:

- Laboratory replicates
- Values obtained though serial dilution
- Sample values combined with the values of duplicates
- Replicates of duplicates
- Any combination of these.

Values acquired from APPL are for comparative purposes only and were not incorporated into the final value reported. The QA/QC section addresses variation in these values.

Total pesticide concentration in the water column is a combination of two elements. The first is the concentration derived from the filtered water analysis; that is, the concentration of pesticide in solution. The second is the contribution of concentration by the adherence of pesticide to the suspended solid particles. However, the determination of this second element is not straightforward. The particulate pesticide concentration determined through analysis is overstated due to a certain amount of water remaining on the filter even after field pressing. The amount of pesticide associated with that water was determined by multiplying the concentration ascertained via the filtered water analysis by the volume remaining on the filter. (Recall that the filter with sample is wet-weighed, dehydrated then reweighed (section 3.2.1), giving a water weight that is divided by the density of water to obtain a volume.) This amount of pesticide is subtracted from the total determined to be in the sample (total concentration (ng/kg) determined via ELISA analysis multiplied by total dry weight with the filter weight taken out). Finally, this new pesticide amount is divided by the weight of the particulate matter giving a new estimated SS pesticide concentration (ng/kg) lower than that determined by the initial SS analysis. The new value was then multiplied by the TSS concentration (mg/L) and a conversion factor to convert the SS contribution into ng/L. This value added to that of the filtered water gave a total pesticide concentration in the water column.

Instantaneous loads were calculated by multiplying the concentration (ng/L) by the discharge (L/sec) and conversion factor to get grams per day (g/day). Total loads were estimated by multiplying the instantaneous load with the appropriate number of days determined for the sampling period. This is typically determined to be the number of days between sampling date mid-points.

4 Results

4.1 Hydrology

Streamflow during the first ambient monitoring runs (July-October 2002) was dominated by agricultural and urban runoff. The last significant rainfall in the area occurred in May '02 (see Fig. 11). There is no significant natural perennial water feeding these water bodies.

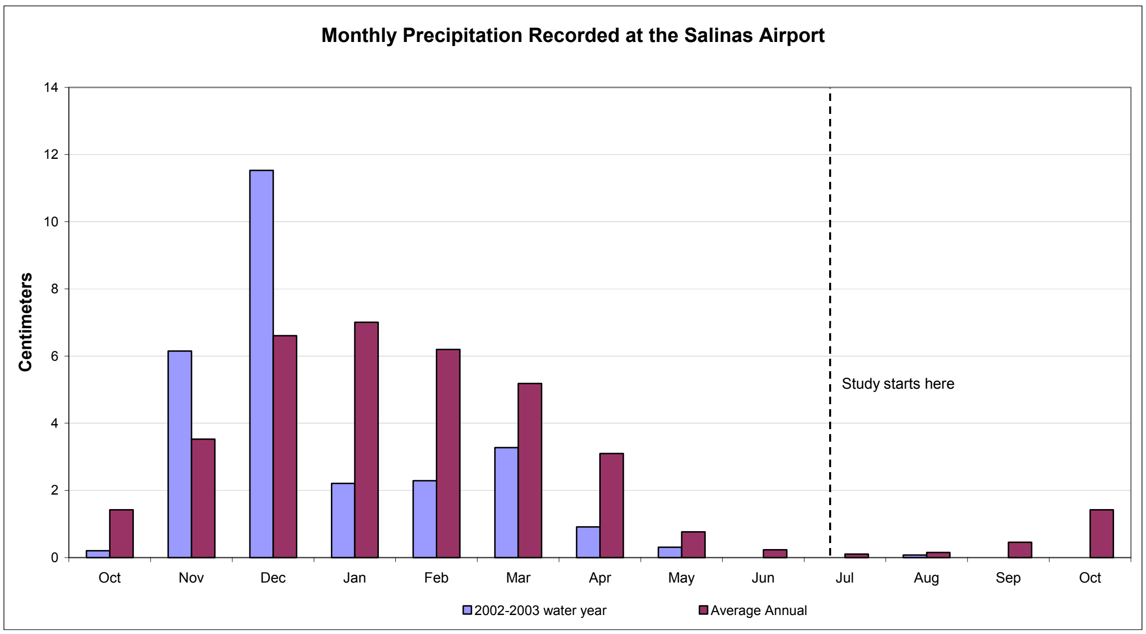

Figure 11. Average annual and water year 2002 precipitation recorded at the Salinas airport. Data from the California Department of Water Resources http://cdec.water.ca.gov/cgi-progs/previous/PRECIPOUT

The Salinas River hydrology during the dry season (May to November) is largely determined by water releases from the Nacimiento and San Antonio reservoirs. These flows are used for groundwater recharge and managed so that flow reaches the lower Salinas River and percolates without being lost to the ocean. Published stream flow data from the USGS station at Spreckels (approx. 5 km upstream of SAL-DAV) are not yet available, but it is anticipated that minimal surface flow made it past this point to affect the system downstream. The middle reaches of the Salinas River are therefore somewhat disconnected from the lower reaches during the times periods of ambient monitoring for this study, with the possible exception of sub-surface flow.

The primary source of surface water feeding the lower reaches of the Salinas River, the Reclamation Ditch and the Blanco Drain systems during ambient sampling runs was agricultural return water from adjacent farms. Urban runoff from the city of Salinas also contributed to the system via the Reclamation canal. No water from the Espinosa Lake system is believed to have entered the Reclamation Ditch during the first five ambient sampling runs.

4.2 Application of Chlorpyrifos and Diazinon

Data for pesticide applications to the Salinas Valley are not currently available for the study time frame. When available, analysis of this data will include:

- Chlorpyrifos applied (kg/hectare) during the ambient monitoring period represented spatially and temporally with discussion on uses
- Diazinon applied (kg/hectare) during the ambient monitoring period represented spatially and temporally with discussion on uses

4.3 Quality Assurance/Quality Control (QA/QC)

Forty-seven ELISA runs were performed with the average correlation coefficient of the calibrators at 0.97 (SD=0.02). Eighty-three percent of the calibrator pairs had CV's of less than 15%. The QA/QC data are presented in Appendix 2, Tables 1 & 2 and are discussed as follows:

4.3.1 Field Method Blanks

The contamination of environmental water samples due to multiple sources was found to be insignificant. The average concentration (n=6) for chlorpyrifos water blanks was 40 ppt (SD=31); diazinon, 32 ppt (SD=14). The estimated detection limits (EDLs) CCoWS established for the ELISA kits are 63 ppt for chlorpyrifos and 25 ppt for diazinon. Since the average blank value for chlorpyrifos concentration is much less than the EDL, minimal contamination is likely to have occurred to water samples. While a concentration of 32 ppt is above the EDL for diazinon and indicates some level of contamination, the magnitude of environmental concentrations measured makes the contamination insignificant in comparison.

Contamination of filtered particulate was found insignificant with one exception, but the source was mitigated. Three sample blanks were processed to evaluate the filtration and methanol extraction process for contamination. Chlorpyrifos had 2 non-detects (nd) and one sample concentration was 5,889 ppt. Diazinon had values of 6,148, 1,365, and 169,778 ppt. The EDL's of chlorpyrifos and diazinon in suspended particulate are approximately 47,000 and 18,800 ppt, respectively. Since the values obtained from the blanks were well below the EDLs, contamination due to field collection or methanol extraction techniques was not significant in most cases. However, the diazinon value of 170 ppb did indicate a contamination issue with that blank. Cleaning techniques in both field and lab were modified to address the issue and subsequent method blanks indicated no contamination.

Contamination to rinse water used to clean benthic sampling equipment was found insignificant. Samples of rinse water were collected and analyzed for contamination on two sampling runs. The average value for these blanks were 25 ppt for chlorpyrifos and 48 ppt for diazinon, well below the benthic EDLs of 3,650 ppt (chlorpyrifos) and 1,459 ppt (diazinon).

4.3.2 Lab Method Blanks

High Performance Liquid Chromatography (HPLC) water and methanol used in the processing of samples were tested for contamination during the first and last sampling runs. No levels of chlorpyrifos or diazinon were detected in these blanks.

4.3.3 Laboratory-fortified matrices (spikes)

Twelve environmental samples with five replicates of various matrices were spiked with the control standards for chlorpyrifos and diazinon and analyzed using ELISA. The average recovery for all spikes (n=17) was 70.8% (SD=31.8%). Recovery was higher for chlorpyrifos (74.3%) than diazinon (67.7%). The recovery percentages are low, but acceptable. Recoveries may be consistently low due to possible bias in the method of calculation. A control standard was used to spike the environmental sample, but the control concentration value determined by ELISA analysis was used to compute spike recovery, not the intended concentration value. Control concentration values were 35% above the intended values, on average (see section 4.3.4).

4.3.4 Controls, replicates and duplicates

At least one control per sampling run was analyzed for each analyte during both water and sediment analysis. The mean concentration of all controls (n=12) for chlorpyrifos was 683 ppt (CV=20%), giving a relative percent difference (RPD) from its intended value (500 ppt) of 36.5%. The mean value of all controls (n=15) for diazinon was 403 ppt (CV=111%), giving an RPD from its intended value (300 ppt) of 34.2%. Control standard values for chlorpyrifos and diazinon combined averaged 35% above expected values. When compared to results from an outside laboratory using GC analysis, average results obtained by CCoWS for chlorpyrifos and diazinon combined were approximately 51% higher. This suggests a potential positive bias of ELISA, and is consistent with results from other studies (Sullivan and Goh, 2000; Dileanis, 2002).

The average CV for all replicates (n=167 total replicates) is 30.4% (SD=33.3%). This variation is due to many factors including but not limited to:

- Pipetting of minute (5-100µL) volumes
- Serial dilutions of several orders of magnitude
- Variance of microwell antibody coating
- Operator error and technique
- Quality of calibration model
- Position of derived value on modeled curve

There were 18 samples replicated during chlorpyrifos analysis averaging CV=14.1% (SD=9.7%). Fifty-one samples were replicated during diazinon analysis averaging CV= 36.2 % (SD=36.7%).

The variation between like environmental samples was less than the variation in test methodology. The average RPD for all (n=16) duplicates analyzed by ELISA was 28.2% (SD=25.3%); the average CV=19.9% (SD=17.9%). The CV for all duplicates (19.9%) is lower than the CV for all replicates (30.4%). This suggests that the variation that has been determined between like environmental samples (duplicates) is likely due to the analytical method used.

4.3.5 Inter-laboratory/inter-analysis method comparisons

Results obtained from APPL for duplicate samples are summarized in Appendix 2, Table 2. Full laboratory reports from APPL are presented in Appendix 2.

Thirteen samples analyzed by APPL were below the PQL's for the test. When compared to the duplicate samples analyzed by ELISA, nine were below the PQLs and three had ELISA results equal to or slightly greater than the PQLs of the GC method. One sample had an ELISA value nearly 6 times greater than the PQL of

GC suggesting the possibility of contamination of a duplicate sometime after sampling.

The remaining seven samples had values above the PQL of the test. ELISA analysis for chlorpyrifos (n=3) averaged an error 61% higher than the GC value. ELISA analysis for diazinon (n=4) averaged an error 41% higher than the GC value. The average percent difference between the two methods was 33%.

4.4 Benthic Sediment Size Categories

For the October run, a portion of the benthic samples was used to characterize the percentage of sand to the silt/clay component of the samples. The results are summarized in Chapter 4, Table 2. SAL-DAV, BLA-PUM, OLS-POT and EPL-EPL had relatively high amounts of silt and clay component (from 78-98%), while SAL-MON and REC-JON had slightly lower equal values (66%). EP1-ROG had a lesser value of 44% silt/clay, due likely to the higher velocity of water at this site with little opportunity for upstream accumulation. MOS-SAN had relatively little silt/clay (6%), undoubtedly due to the tidal activity at this site.

Table 2. Percent by weight of sand vs.silt/clay of benthic samples obtained during the October 2002 ambient run

Site	% sand	% silt/clay
SAL-DAV	12	88
SAL-MON	34	66
BLA-COO	14	86
BLA-PUM	22	78
REC-JON	34	66
OLS-POT	2	98
MOS-SAN	94	6
EP1-ROG	56	44
EPL-EPL	13	87

4.5 Concentrations of Chlorpyrifos and Diazinon

The concentrations of chlorpyrifos and diazinon for samples collected during the summer 2002 ambient monitoring period are summarized in Appendix 1, Table 3 and illustrated in Appendix 1, Figs. 1-18.

4.5.1 Chlorpyrifos

Concentrations of chlorpyrifos in filtered water samples ranged from 44 ppt at OLS-POT to 849 ppt at EP1-ROG. Suspended solids (SS) concentrations in the water column ranged from non-detectable (ND) at several locations to 28 ppb at EP1-ROG. Total water column concentrations ranged from 45 ppt at OLS-POT to 28 ppb at EP1-ROG. Percentage of the SS portion of total water column concentrations ranged from 0 to 97%, with the average at 24% (SD=29). Benthic concentrations ranged from ND at several locations to 499 ppb at REC-JON.

The average ambient chlorpyrifos concentration for each of the nine sites is summarized in Appendix 1, Table 3. The average benthic and average total water column concentrations are depicted in Chapter 4, Fig. 12. Figure 12 indicates that chlorpyrifos concentrations in the water column are not highly variable temporally or spatially, with the noted exception of the Espinosa system. Again, with the exception of the Espinosa system, concentrations are relatively low, averaging about 77 ppt (%CV=26). However, this still exceeds the CMC of 20 ppt for chlorpyrifos. Benthic concentrations appear highly variable both temporally and spatially. Temporal variation may be due to their true values being just below the detection limits of the test (approx. 3 600 ppt). However, benthic concentrations are more variable than water column concentrations overall.

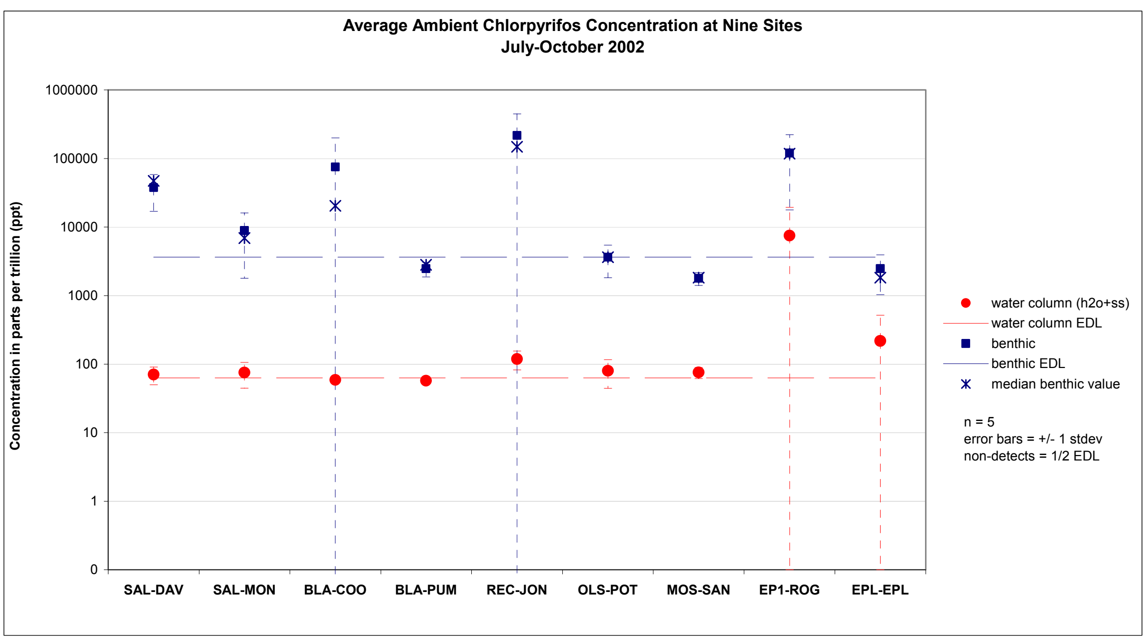

Figure 12. Average ambient chlorpyrifos concentrations at the nine sites, summer 2002.

4.5.2 Diazinon

Concentrations of diazinon in filtered water samples ranged from ND at MOS-SAN to 67 ppb at EP1-ROG. The SS concentrations in the water column ranged from 3 ppt at BLA-PUM and SAL-MON to 674 ppb at EP1-ROG. Total water column concentrations ranged from 17 ppt at MOS-SAN to 742 ppb at EP1-ROG. Percentage of the SS portion of total water column concentrations ranged from 3 to 100%, with the average at 45% (SD=38%). Benthic concentrations ranged from 538 ppt at MOS-SAN to 778821 ppt at EP1-ROG.

The average ambient diazinon concentration for each of the nine sites is summarized in Appendix 1, Table 3. The average benthic and average total water column concentration values are depicted in Chapter 4, Fig. 13. This figure indicates that diazinon values in the water column are more variable temporally and spatially compared to chlorpyrifos. Again, EP1-ROG has the highest concentrations of all sites.

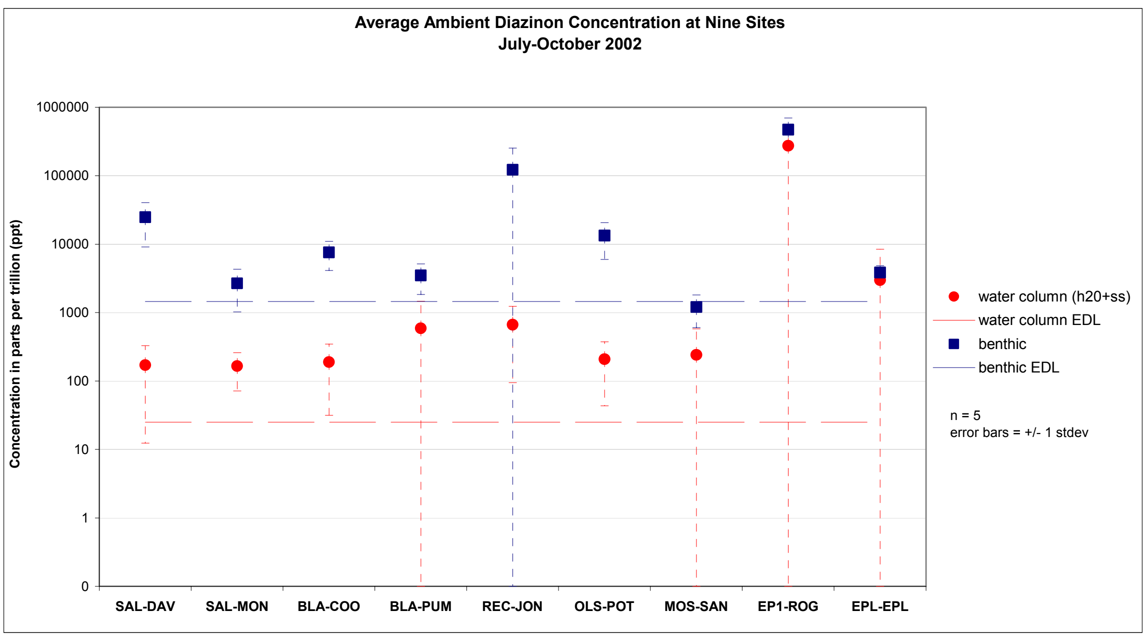

Figure 13. Average ambient diazinon concentration values of all measurements at each site.

With the exception of the Espinosa system, the average ambient concentration for all sites is 319 ppt (CV=98%). Benthic concentration tends to be less variable than chlorpyrifos (due to zero NDs) and appears slightly more variable both temporally and spatially than water column concentrations. Both the

Reclamation Ditch and the Blanco Drain systems water column averages are higher than the Salinas River system sites, with REC-JON having the highest values overall for both benthic and water column concentrations (again, outside the Espinosa system). REC-JON is just downstream (approx. 4 km) from the City of Salinas, which uses the Reclamation Ditch as a conduit for urban run off.

With the exception of MOS-SAN, all sites have diazinon concentrations well above the EDLs of the test. The MOS-SAN site is tidally influenced, which can dilute the entering fresh water considerably (note the high salinity values for MOS-SAN in Appendix 1, Table 4).

Benthic concentrations at SAL-DAV are generally higher than at SAL-MON. This may indicate that SAL-DAV is closer to an input source, as water velocities were not sufficient to transport bedload during this period. The same may be true of the Blanco system, which exhibits the same trend. Conversely, both reaches exhibit an increase in water column concentrations downstream. Diazinon has a solubility of 60 mg/L at 20°C and may have a low or moderate tendency to remain bound to sediment (Azimi-Gaylon et. al., 2001). Diazinon from sediments may be diffusing into solution and therefore increasing downstream concentrations. Alternatively, there may be other non-sediment oriented sources of diazinon entering the waterway. These sources are agricultural.

At OLS-POT, the water column concentrations do not demonstrate the downstream trend of increasing. Sampling at this site occurs immediately upstream of the tide gates, which do not entirely seal against seepage of seawater during high tides (note the rapidly increasing salinity with depth of OLS-POT in Appendix 1, Table 4). Therefore, this site's fresh water gets diluted with seawater and lowers the concentration. Benthic concentrations at this site are relatively high compared to other sites. Again, this may indicate proximity to a source.

4.6 Comparisons between Pesticide and Total Suspended Solids Concentrations

The average TSS measured at EP-ROG was 406 mg/L, while the average for all other sites combined (excluding EPL-EPL) was 62 mg/L (Appendix 1, Table 3). The relationship between total water column pesticide concentration and TSS is illustrated in Chapter 4, Fig. 14. Only the data for sites with measurable loads is represented. Note the trend of increasing total water column concentrations as TSS increases. This indicates how loads can increase when more sediment is entrained in the water column.

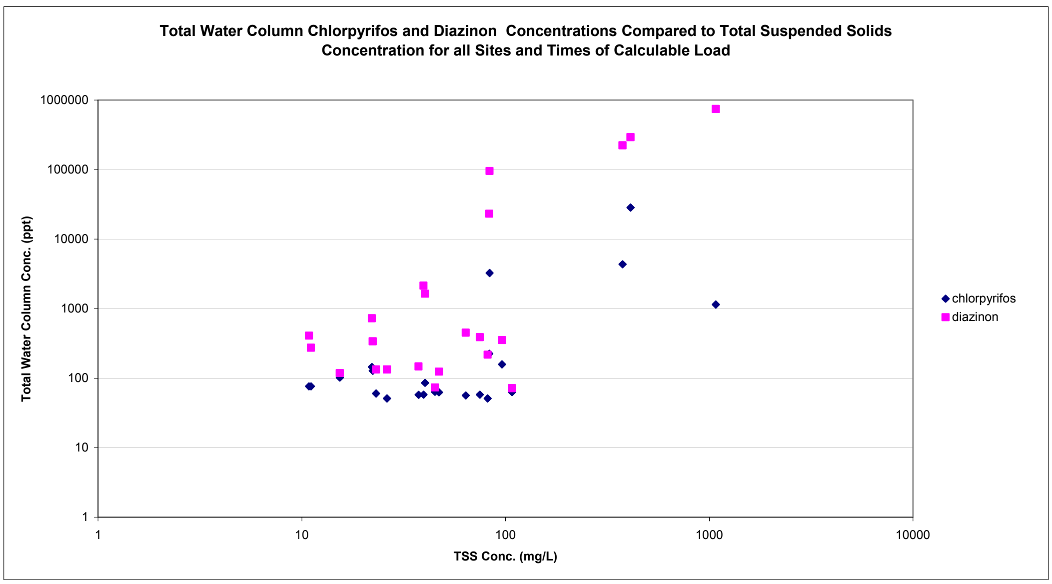

Figure 14. Total water column chlorpyrifos and diazinon concentrations vs. TSS concentration of sites and times of measurable load.

4.7 Loads of Chlorpyrifos and Diazinon

The instantaneous (g/day) and total (kg) loads for water, SS and combined concentrations estimated for all sites throughout the monitoring period are listed in Appendix 1, Table 5. Appendix 1, Figures 19-23 represent the total water column loads graphically. Appendix 1, Figures 24-33 show the relative contribution of water and SS loads to the total load for each site through the monitoring period.

Note that some sites did not have measured discharges. At SAL-DAV, SAL-MON, OLS-POT and MOS-SAN, discharge was difficult to estimate due to low or no velocities in deep (unwadable) water. SAL-DAV, SAL-MON and OLS-POT behaved more as pools (receiving sites) than streams (flux sites) during this period. The tidal influence also confounds the issue at OLS-POT and MOS-SAN, while OLS-POT has tide gates that further complicate flow measurements. EPL-EPL, being a lake, had no leaving loads associated with it. BLA-COO, REC-JON and EP1-ROG all had consistently measurable discharges for load calculations.

One BLA-PUM discharge measurement was obtained during the last ambient run. Earlier sampling runs had higher water levels than this last one (with the exception of the August run). The pumping of water from this site to the Salinas also occurred intermittently, but at times the pump was broken entirely (noticed during the first ambient run). Loads from BLA-PUM were estimated based on the discharge of overflow water from the last ambient run. Therefore, loads could be higher at this site than were estimated.

SAL-DAV had only two periods of flow measured. Total chlorpyrifos load for the entire monitoring period was estimated to be 0.07 kg. This load was entirely carried within the water component (Appendix 1, Fig. 24). Total diazinon load was 0.27 kg with much of it carried as water load (Appendix 1, Fig. 25). During the July run, 62% of the load was attributed to the SS concentration contribution.

BLA-COO had a total chlorpyrifos load of 0.03 kg and total diazinon load of 0.13 kg during the monitoring period. Most of the load at all times for both analytes was found as water load (Appendix 1, Fig. 26 & 27).

BLA-PUM had a total chlorpyrifos load of .03 kg and total diazinon load of .33 kg. Again, the bulk of these loads are associated with water load (Appendix 1, Fig. 28 & 29). While the chlorpyrifos load had not changed from the upstream BLA-COO load, the diazinon load was nearly three times as high.

REC-JON total chlorpyrifos load for the monitoring period was 0.06 kg; diazinon, 0.32 kg. Chlorpyrifos loads were double for the Reclamation Ditch system than for the Blanco Drain system while diazinon loads remained relatively equal. While both the diazinon and chlorpyrifos loads were largely water load, the chlorpyrifos load had a significant increase (from an average of 2% at BLA-PUM to 28%) in its relative contribution compared to the Salinas and Blanco systems (Appendix 1, Fig.30 &31).

EP1-ROG had a total chlorpyrifos load of 1.7 kg and diazinon 74.7 kg. These loads are higher than any other site. Unlike previously discussed loads, the SS load for both chlorpyrifos and diazinon makes up the bulk of the total load, averaging 82% for chlorpyrifos and 90% for diazinon (Appendix 1. Fig. 32 & 33).

5 Summary and Conclusions

Nine sampling sites in lower Salinas Valley 303(d) listed water bodies were monitored for the pesticides chlorpyrifos and diazinon five times during the summer of 2002 from July through October to determine ambient levels. At each site water was filtered and collected for analysis while the filter with particulate were collected as another sample. A benthic sample was also obtained. The samples were analyzed using ELISA technology.

Average chlorpyrifos concentrations in the water column at six of the nine sites were near the estimated detection limit (EDL, 63 ng/L) for the ELISA test. At this level, any chlorpyrifos detected is over the criterion maximum concentration (CMC) of 20 ng/L. Concentrations ranged from 45 ng/L to 28.5 µg/L. Of 45 water column samples analyzed, 14 were below the test EDL. Concentrations in the benthic samples ranged from non-detectable to 295 µg/kg. The highest average chlorpyrifos concentrations for both water column and benthic samples were obtained from site EP1-ROG. Loads for the period ranged from 0.03 kg in the Blanco system to 1.7 kg at EP1-ROG. Although data indicated loads in solution were most common, data from both REC-JON and EP1-ROG suggest that suspended sediment can be an important mode of transport for chlorpyrifos as well. Suspended solids concentrations were generally low in most cases, with the exception of the Espinosa system.

Diazinon concentrations in the water column ranged from 17 ng/L to 741.6 µg/L. Only one sample value was below the test EDL (25 ng/L). Of 45 water column samples analyzed, 7 were below the CMC of 80 ng/L. Benthic concentrations ranged from non-detectable to 778.8 µg/kg. The highest average diazinon concentrations for both water column and benthic samples were obtained from site EP1-ROG. Loads ranged from 0.13 kg in the Blanco system to 74.7 kg at EP1-ROG for the sampling period. Like chlorpyrifos, diazinon in solution tended to be the primary mode of transport, but EP1-ROG data indicates that it can also be transported significantly on suspended solids.

Overall analysis indicates that the highest pesticide levels for both analytes are detected in the Reclamation Ditch and the Espinosa system. These sites have runoff sources from urban and greenhouse use.

6 References

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7 Appendix 1

Table 1. Summary of data found to date of chlorpyrifos and diazinon concentrations found in sediment or water of the Salinas Valley, California 303(d) listed waterbodies for pesticides

Table 2. Schedule for diazinon and chlorpyrifos monitoring in impaired surface waters of the lower Salinas region

Table 3. Summary of concentration data used for calculations of summer 2002 ambient chlorpyrifos and diazinon values derived from ELISA analysis

Table 4. Data of depth profiles performed during the July and October ambient sampling runs taken with a YSI for each site

Table 5. Summary of load calculations of chlorpyrifos and diazinon for the summer 2002 ambient monitoring period

Figures 1 – 18. Water column and benthic concentrations of chlorpyrifos and diazinon at each of the nine sites for the summer 2002 ambient runs

Figures 19 – 23. Estimated loads for chlorpyrifos and diazion at five sites for the summer 2002 ambient runs

Figures 24 – 33. Comparison of water vs. suspended sediment loads for chlorpyrifos and diazionon at five sites for the summer 2002 ambient runs

Appendix 1, Table 1. Summary of data found to date of chlorpyrifos and diazinon concentrations (ppb) found in sediment or water of the Salinas Valley, California 303(d) listed waterbodies for pesticides

Central Coast Ambient Monitoring Program (CCAMP):

This list comprises all data within the CCAMP database that has examined chlorpyrifos and diazinon in sediment or water.

Negative numbers indicate non-detects (assumed and needs verification)

Project SiteTag	CCoWS Site Code	Waterbody	Location/bridge	DateTime	MATRIX	CLPYR (ppb)	DIAZN (ppb)
309ALD	REC-BOR	Salinas Reclamation Canal	Boronda Rd	24-06-1999 0:00	SED	-1.25	-1
309ALU	ALI-AIR	Salinas Reclamation Canal	Airport Rd	24-06-1999 0:00	SED	-1.25	-1
306MOR	MCS-HWI	Moro Cojo Slough	Highway 1	30-03-1998 9:15	SED	2.5	5
306MOR	MCS-HWI	Moro Cojo Slough	Highway 1	28-06-1999 17:05	SED	-1.25	-1
306MOS	MCS-MOS	Moss Landing Harbor	Moss Landing Rd	30-03-1998 11:10	SED	2.5	5
309OLD	OLS-MON	Old Salinas River	Monterey Dunes Colony Rd	30-03-1998 11:00	SED	2.5	5
309POT	OLS-POT	Old Salinas River	Potero Rd (Tide Gates)	28-06-1999 15:40	SED	-1.25	-1
309SBR		Salinas River (Lower)	#N/A	30-03-1998 10:30	SED	2.5	5
309DAV	SAL-DAV	Salinas River (Lower)	Davis Rd	24-06-1999 0:00	SED	-1.25	-1
309SAC	SAL-CHU	Salinas River (Lower)	Chualar River Rd	24-06-1999 0:00	SED	-1.25	-1
309SDR	DRN-DAV	Salinas River (Lower)	300m upstream from Davis Rd	24-06-1999 0:00	SED	-1.25	-1
309SBR		Salinas River (Lower)	#N/A	28-06-1999 16:20	SED	-1.25	-1
309DSA	SAL-CAT	Salinas River (Mid)	along Cattleman Rd	24-06-1999 0:00	SED	-1.25	-1
309GRN	SAL-GRE	Salinas River (Mid)	Greenfield	24-06-1999 0:00	SED	-1.25	-1
309KNG	SAL-KIN	Salinas River (Mid)	King City	24-06-1999 0:00	SED	-1.25	-1
309PSO	SAL-CRE	Salinas River (Upper)	Creston Rd	23-06-1999 0:00	SED	-1.25	-1
309USA	SAL-BRA	Salinas River (Upper)	Bradley Rd	23-06-1999 0:00	SED	-1.25	-1
309TEM	TEM-PRE	Tembladero Slough	Preston Rd	30-03-1998 10:45	SED	2.5	5
309TEM	TEM-PRE	Tembladero Slough	Preston Rd	28-06-1999 16:45	SED	-1.25	-1
305WAT		Watsonville Slough	#N/A	30-03-1998 12:45	SED	2.5	5
306ELK	ELK-KIR	Elkhorn Slough	Kirby Park	30-03-1998 11:45	SED	2.5	5
306ELK	ELK-KIR	Elkhorn Slough	Kirby Park	28-06-1999 14:35	SED	-1.25	-1
309SDW		#N/A	#N/A	28-06-1999 15:55	SED	-1.25	-1
309SUN	SAL-GAR	#N/A	River Rd (Nr East Garrison)	23-06-1999 0:00	SED	-1.25	-1
309SEC	ARR-ELM	Arroyo Seco River	Elm Rd (USGS stn) (Green br.)	24-06-1999 0:00	SED	-1.25	-1
309ATS	ATA-H41	Atascadero Creek(309)	Hwy 41, Atascadero	23-06-1999 0:00	SED	-1.25	-1
315ATA		Atascadero Creek(315)	#N/A	20-03-1998 15:15	SED	2.5	5
309SAN	ANT-101	San Antonio River	Hwy 101	23-06-1999 0:00	SED	-1.25	-1
309LOK	SLC-FIR	San Lorenzo Creek	First Street (G15, King City)	24-06-1999 0:00	SED	-1.25	-1
309LOR	SLC-BIT	San Lorenzo Creek	Bitterwater Rd (USGS stn)	24-06-1999 0:00	SED	-1.25	-1
309MON		Monterey Harbor	#N/A	30-03-1998 9:45	SED	2.5	5
309NAC	NAC-101	Nacimiento River	Hwy 101	23-06-1999 0:00	SED	-1.25	-1

Bay Protection and Toxic Cleanup Program (BPTC) (data from "Chemical & biological measures of sediment quality in the central coast region" SWRCB, 1998. (negatives assumed non-detects)

Project SiteTag	CCoWS Site Code	Waterbody	Location/bridge	DateTime	MATRIX	CLPYR (ppb)	DIAZN (ppb)
30007	MOS-SAN	Moss Landing Harbor	Sandholt Rd	09-May-96	H2O	-8	
30007	MOS-SAN	Moss Landing Harbor	Sandholt Rd	21-Dec-92	SED	-9	
30011	SAL-MON	Salinas River Lagoon	Del Monte Rd	21-Dec-92	SED	-9	
30019	MCS-HWI	Moro Coho Slough	#N/A	22-Dec-92	SED	-9	
30007	MOS-SAN	Moss Landing Harbor	Sandholt Rd	15-Jun-94	SED	-9	
30007	MOS-SAN	Moss Landing Harbor	Sandholt Rd	15-Jun-94	SED	-9	

Appendix 1, Table 1. Summary of data found to date of chlorpyrifos and diazinon concentrations (ppb) found in sediment or water of the Salinas Valley, California 303(d) listed waterbodies for pesticides

Bay Protection and Toxic Cleanup Program (BPTC) (data from "Chemical & biological measures of sediment quality in the central coast region" SWRCB, 1998. (negatives assumed non-detects)

Project SiteTag	CCoWS Site Code	Waterbody	Location/bridge	DateTime	MATRIX	CLPYR (ppb)	DIAZN (ppb)
30007	MOS-SAN	Moss Landing Harbor	Sandholt Rd	15-Jun-94	SED	-9	
30019	MCS-HWI	Moro Coho Slough	#N/A	17-Jun-94	SED	-9	
30007	MOS-SAN	Moss Landing Harbor	Sandholt Rd	09-May-96	SED	6.31	
30007	MOS-SAN	Moss Landing Harbor	Sandholt Rd	08-May-97	SED	3.29	
36003		Central Tembladero	#N/A	08-May-97	SED	1.68	
36002		Tembladero Mouth	#N/A	08-May-97	SED	5.95	
36004		Upper Tembladero-Salinas City	#N/A	08-May-97	SED	17.7	
36005	EPL-EPL	Espinosa Slough	Espinosa Lake	08-May-97	SED	2.7	
36006		Alisal Slough	#N/A	08-May-97	SED	16.4	
36007	OLS-POT	Old Salinas River Channel	Potero Rd (Tide Gates)	08-May-97	SED	0.95	

Department of Pesticide Regulation (DPR) (data from: "Temporal distribution of insecticide residues in four California rivers" Ganapathy et. al. 1998)

Project SiteTag	CCoWS Site Code	Waterbody	Location/bridge	DateTime	MATRIX	CLPYR (ppb)	DIAZN (ppb)
	SAL-GON	Salinas R	River Rd Gonzales Bridge	07-Jul-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	01-Aug-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	09-Aug-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	16-Aug-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	23-Aug-02	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	30-Aug-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	06-Sep-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	08-Sep-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	13-Sep-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	20-Sep-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	27-Sep-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	04-Oct-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	11-Oct-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	18-Oct-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	25-Oct-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	01-Nov-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	08-Nov-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	15-Nov-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	22-Nov-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	29-Nov-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	06-Dec-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	08-Dec-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	13-Dec-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	20-Dec-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	27-Dec-94	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	03-Jan-95	H2O	0	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	10-Jan-95	H2O	0.11	0
	SAL-GON	Salinas R	River Rd Gonzales Bridge	17-Jan-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	24-Jan-95	H2O	0	0

Appendix 1, Table 1. Summary of data found to date of chlorpyrifos and diazinon concentrations (ppb) found in sediment or water of the Salinas Valley, California 303(d) listed waterbodies for pesticides

Department of Pesticide Regulation (DPR) (data from: "Temporal distribution of insecticide residues in four California rivers" Ganapathy et. al. 1998)

Project SiteTag	CCoWS Site Code	Waterbody	Location/bridge	DateTime	MATRIX	CLPYR (ppb)	DIAZN (ppb)
	SAL-CHU	Salinas R	Chualar River Rd	31-Jan-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	07-Feb-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	14-Feb-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	21-Feb-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	23-Feb-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	28-Feb-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	07-Mar-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	14-Mar-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	21-Mar-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	28-Mar-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	04-Apr-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	11-Apr-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	18-Apr-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	25-Apr-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	02-May-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	09-May-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	16-May-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	23-May-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	30-May-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	06-Jun-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	13-Jun-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	20-Jun-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	26-Jun-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	27-Jun-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	04-Jul-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	11-Jul-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	18-Jul-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	25-Jul-95	H2O	0	0
	SAL-CHU	Salinas R	Chualar River Rd	01-Aug-95	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	29-Aug-94	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	04-Oct-94	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	02-Nov-94	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	28-Nov-94	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	03-Jan-95	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	06-Feb-95	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	06-Mar-95	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	06-Apr-95	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	03-May-95	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	30-May-95	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	31-May-95	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	26-Jun-95	H2O	0	0.2
	SAL-MON	Salinas Lagoon	Del Monte Rd	01-Aug-95	H2O	0	0
	SAL-MON	Salinas Lagoon	Del Monte Rd	01-Aug-95	H2O	0	0

Appendix 1, Table 1. Summary of data found to date of chlorpyrifos and diazinon concentrations (ppb) found in sediment or water of the Salinas Valley, California 303(d) listed waterbodies for pesticides

United States Geological Survey (USGS) (data from water quality website @ http://waterdata.usgs.gov/nwis/qwdata&introduction)

Project SiteTag	CCoWS Site Code	Waterbody	Location/bridge	DateTime	MATRIX	CLPYR (ppb)	DIAZN (ppb)
11143500	SAL-POZ	Salinas R	Pozo Rd	12-29-71 13:30	H2O		0
11143500	SAL-POZ	Salinas R	Pozo Rd	3-7-72 11:00	H2O		0
11143500	SAL-POZ	Salinas R	Pozo Rd	11-22-72 13:15	H2O		0
11143500	SAL-POZ	Salinas R	Pozo Rd	2-13-73 13:00	H2O		0
11143500	SAL-POZ	Salinas R	Pozo Rd	3-20-73 12:30	H2O		0
11143500	SAL-POZ	Salinas R	Pozo Rd	4-19-73 16:30	H2O		0
11143500	SAL-POZ	Salinas R	Pozo Rd	9-5-73 11:15	H2O		0
11143500	SAL-POZ	Salinas R	Pozo Rd	12-11-73 12:30	H2O		0
11143500	SAL-POZ	Salinas R	Pozo Rd	1-21-74 15:30	H2O		0
11145000	SAL-PIL	Salinas R	Las Pilitas Rd	3-7-72 11:45	H2O		0.01
11145000	SAL-PIL	Salinas R	Las Pilitas Rd	6-29-72 11:00	H2O		0
11145000	SAL-PIL	Salinas R	Las Pilitas Rd	6-30-72 8:30	H2O		0
11145000	SAL-PIL	Salinas R	Las Pilitas Rd	12-11-73 13:20	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	12-29-71 10:00	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	3-7-72 12:15	H2O		0.01
11147500	SAL-CRE	Salinas R	Creston Rd	1-11-73 12:40	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	2-13-73 16:00	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	3-20-73 14:00	H2O		0.01
11147500	SAL-CRE	Salinas R	Creston Rd	5-17-73 13:15	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	1-21-74 13:15	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	3-4-74 12:30	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	4-15-74 13:00	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	5-10-74 12:45	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	2-3-75 15:30	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	3-4-75 12:00	H2O		0
11147500	SAL-CRE	Salinas R	Creston Rd	5-6-75 12:30	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	12-28-71 15:30	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	3-7-72 14:45	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	11-27-72 11:15	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	2-7-73 10:30	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	3-21-73 14:30	H2O		0.01
11150500	SAL-WUN	Salinas R	Wunpost Rd	5-17-73 16:00	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	9-5-73 14:30	H2O		0.01
11150500	SAL-WUN	Salinas R	Wunpost Rd	12-11-73 15:00	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	1-31-74 12:15	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	3-4-74 13:45	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	4-15-74 14:40	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	10-3-74 10:00	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	2-4-75 16:00	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	3-4-75 14:30	H2O		0
11150500	SAL-WUN	Salinas R	Wunpost Rd	5-19-75 14:00	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	12-28-71 10:30	H2O		0

Appendix 1, Table 1. Summary of data found to date of chlorpyrifos and diazinon concentrations (ppb) found in sediment or water of the Salinas Valley, California 303(d) listed waterbodies for pesticides

United States Geological Survey (USGS) (data from water quality website @ http://waterdata.usgs.gov/nwis/qwdata&introduction)

Project SiteTag	CCoWS Site Code	Waterbody	Location/bridge	DateTime	MATRIX	CLPYR (ppb)	DIAZN (ppb)
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	3-8-72 9:00	H2O		0.01
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	11-27-72 13:30	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	2-8-73 9:30	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	3-23-73 10:00	H2O		0.01
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	5-18-73 11:30	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	9-6-73 10:15	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	12-10-73 9:45	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	1-31-74 13:45	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	3-4-74 15:00	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	4-16-74 9:40	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	5-13-74 11:15	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	10-3-74 11:30	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	2-5-75 13:30	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	3-5-75 12:10	H2O		0
11151700	SAL-SOL	Salinas R	Hwy 101 at Soledad	5-7-75 13:00	H2O		0
11152300	SAL-CHU	Salinas R	Chualar River Rd	8-16-77 13:15	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	12-12-77 12:15	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	12-12-77 12:15	SED		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	2-27-78 15:30	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	5-22-78 12:15	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	5-22-78 12:15	SED		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	8-14-78 14:00	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	11-13-78 14:30	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	11-13-78 14:30	SED		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	2-12-79 13:00	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	5-15-79 12:30	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	5-15-79 12:30	SED		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	8-20-79 13:00	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	11-19-79 11:00	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	11-19-79 11:00	SED		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	3-10-80 13:00	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	8-19-80 13:30	H2O		--
11152300	SAL-CHU	Salinas R	Chualar River Rd	5-17-82 13:30	H2O		0.01
11152500	SAL-SPR	Salinas R	Hwy 68	12-27-71 16:00	H2O		0.01
11152500	SAL-SPR	Salinas R	Hwy 68	3-8-72 10:30	H2O		0.02
11152500	SAL-SPR	Salinas R	Hwy 68	4-12-72 9:10	H2O		0
11152500	SAL-SPR	Salinas R	Hwy 68	6-28-72 9:30	H2O		0.07
11152500	SAL-SPR	Salinas R	Hwy 68	2-8-73 15:45	H2O		0
11152500	SAL-SPR	Salinas R	Hwy 68	3-23-73 14:00	H2O		0
11152500	SAL-SPR	Salinas R	Hwy 68	5-18-73 14:30	H2O		0.01
11152500	SAL-SPR	Salinas R	Hwy 68	12-12-73 11:15	H2O		0
11152500	SAL-SPR	Salinas R	Hwy 68	1-31-74 14:30	H2O		0
11152500	SAL-SPR	Salinas R	Hwy 68	3-2-74 17:40	H2O		0

Appendix 1, Table 1. Summary of data found to date of chlorpyrifos and diazinon concentrations (ppb) found in sediment or water of the Salinas Valley, California 303(d) listed waterbodies for pesticides

United States Geological Survey (USGS) (data from water quality website @ http://waterdata.usgs.gov/nwis/qwdata&introduction)

Project SiteTag	CCoWS Site Code	Waterbody	Location/bridge	DateTime	MATRIX	CLPYR (ppb)	DIAZN (ppb)
11152500	SAL-SPR	Salinas R	Hwy 68	4-16-74 13:00	H2O		0
11152500	SAL-SPR	Salinas R	Hwy 68	5-13-74 13:15	H2O		0.03
11152500	SAL-SPR	Salinas R	Hwy 68	2-3-75 14:45	H2O		0
11152500	SAL-SPR	Salinas R	Hwy 68	3-6-75 14:00	H2O		0
11152500	SAL-SPR	Salinas R	Hwy 68	4-29-75 12:00	SED		--
11152500	SAL-SPR	Salinas R	Hwy 68	5-28-75 13:00	H2O		0.03
11152500	SAL-SPR	Salinas R	Hwy 68	9-9-75 11:30	H2O		--
11152500	SAL-SPR	Salinas R	Hwy 68	11-11-75 13:40	H2O		--
11152500	SAL-SPR	Salinas R	Hwy 68	11-11-75 13:40	SED		--
11152500	SAL-SPR	Salinas R	Hwy 68	2-9-76 12:00	H2O		--
11152500	SAL-SPR	Salinas R	Hwy 68	5-4-76 13:00	H2O		--
11152500	SAL-SPR	Salinas R	Hwy 68	5-4-76 13:00	SED		--
11152500	SAL-SPR	Salinas R	Hwy 68	11-16-76 11:00	SED		--
11152500	SAL-SPR	Salinas R	Hwy 68	9-1-77 16:50	H2O		0.08
11152500	SAL-SPR	Salinas R	Hwy 68	9-1-77 16:50	SED		0.4

Appendix 1, Table 2. Schedule for Diazinon and Chlorpyrifos Monitoring in Impaired Surface Waters of the Lower Salinas Region

Central Coast Watershed Studies (CCoWS): August, 2002
Prepared by Don Kozlowski and Fred Watson

Funded by the State Department of Pesticide Regulation and the State Water Resource Control Board

		Jul	Aug	Sep"a"	Sep"b"	Oct	Nov & Dec'02, Jan, Feb, Mar'03									Apr	May	Jun	Jul	Aug	Sep	Oct
		Summer '02 Ambient Monitoring					Storm A			Storm B			Storm C			Summer '03 Ambient Monitoring						
Site #	Site Code						Pre-	Peak	Post-	Pre-	Peak	Post-	Pre-	Peak	Post-							
1	SAL-DAV	X	O	O	O	O	O bdg	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	SAL-MON	O	X	O	O	O	O		O wdg	O		O	O		O	O	O	O	O	O	O	O
3	BLA-COO	O	O	X	O	O	O	O	O	O wdg	O	O	O	O	O	O	O	O	O	O	O	O
4	BLA-PUM	O	O	O	X	O	O		O	O		O bdg	O		O	O	O	O	O	O	O	O
5	REC-JON	O	O	O	O	X	O	O	O	O	O	O	O wdg	O	O	O	O	O	O	O	O	O
6	OLS-POT	O	O	O	O	O	O	O	O	O	O	O	O	O	O bdg	X	O	O	O	O	O	O
7	MOS-SAN	O	O	O	O	O	O		O	O		O	O		O	O	X	O	O	O bdg	O	O
8	EP1-ROG	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O wdg	O
9	EPL-EPL	O	O	O	O	O	O		O	O		O	O		O	O	O	O	X	O	O	O bdg

O = Normal sampling scheme (Water, Benthic and Suspended Sediment samples for ELISA analysis)
X = Normal sampling scheme with additional Water and Benthic duplicates plus Water and Benthic sampling for GCMS analysis
wdg = water duplicate & water GCMS
bdg = benthic duplicate & benthicGCMS

Notes: QA/QC samples are highlighted in blue. This schedule is tentative. Circumstances such as staff scheduling/availability and weather conditions may necessitate changes.

Appendix 1, Table 3. Summary of concentration data used for calculations of summer 2002 ambient chloprpyrifos and diazinon values derived from ELISA analysis (TSS, total suspended solids; C, chlorpyrifos; D, diazinon; ss, suspended solids)

Site	TSS mg/L	C water ng/L	measured C, ss, ng/kg	est. C conc.of ss ng/kg	Conc of ss C in water column ng/L	Total C conc in water column ng/L	C benthic ng/kg	D water ng/L	measured D, ss, ng/kg	est. D conc.of ss ng/kg	Conc of ss D in water column ng/L	Total D conc in water column ng/L	D benthic ng/kg
Jul-02													
SAL-DAV	15.4	102	27011	24719	0	102	37548	45	4772651	4771634	73	118	24157
SAL-MON	35.7	71	11648	0	0	71	0	89	151500	149392	5	94	934
BLA-COO	107.6	63	n/a	n/a	n/a	63	41296	72	n/a	n/a	n/a	72	9039
BLA-PUM	47.1	63	0	0	0	63	2974	121	68312	66157	3	124	3758
REC-JON	96.2	81	807196	806030	78	158	0	248	1095622	1092048	105	353	2778
OLS-POT	158.0	111	23626	21817	3	115	0	74	190276	189080	30	104	25078
MOS-SAN	139.3	85	10544	9249	1	86	0	31	1265727	1265245	176	208	2090
EP1-ROG	1076.1	119	956927	956609	1029	1148	3535	67235	626868360	626688780	674365	741601	778821
EPL-EPL	804.4	91	31114	29660	24	114	0	103	369665	368017	296	399	4639
Aug-02													
SAL-DAV	18.6	48	87075	83613	2	49	0	29	1271581	1269470	24	53	697
SAL-MON	16.6	50	0	0	0	128	20735	37	279040	278316	5	42	3947
BLA-COO	23.1	58	108059	105582	2	60	15876	100	1469671	1465377	34	134	3330
BLA-PUM	26.2	51	0	0	0	51	2929	124	363741	360946	9	134	6030
REC-JON	22.1	86	2656643	2654536	59	145	499278	697	1381607	1364603	30	728	159153
OLS-POT	53.1	64	8582	7826	0	65	5417	102	354094	352895	19	120	6230
MOS-SAN	183.3	70	0	0	0	70	1817	73	160938	159790	29	102	538
EP1-ROG	83.3	132	1120107	1119255	93	225	268495	3605	234657100	234633849	19534	23139	268495
EPL-EPL	448.3	55	59748	58829	26	81	5055	43	857442	856728	384	427	5055
Sep a-02													
SAL-DAV	10.9	76	0	0	0	76	51260	387	1982660	1961671	21	409	24489
SAL-MON	44.7	45	558833	557809	25	70	6156	108	3591853	3589374	160	269	4817
BLA-COO	63.9	55	23707	22630	1	57	294992	444	118398	109719	7	451	9109
BLA-PUM	39.6	56	38523	37645	1	58	0	1869	7121387	7092330	281	2150	3521
REC-JON	40.3	62	586688	585084	24	86	417248	1620	474671	432819	17	1638	327563
OLS-POT	43.8	53	27561	26878	1	54	3619	192	520311	517845	23	214	12205
MOS-SAN	57.2	68	34230	33212	2	70	2267	0	297583	297583	17	17	1097
EP1-ROG	410.4	849	67300931	67296082	27616	28465	157012	12419	681041686	680970782	279448	291867	644321
EPL-EPL	1088.6	55	0	0	0	55	0	52	311818	310479	338	390	2874

Appendix 1, Table 3. Summary of concentration data used for calculations of summer 2002 ambient chloprpyrifos and diazinon values derived from ELISA analysis (TSS, total suspended solids; C, chlorpyrifos; D, diazinon; ss, suspended solids) (Cont.)

Site	TSS mg/L	C water ng/L	measured C, ss, ng/kg	est. C conc.of ss ng/kg	Conc of ss C in water column ng/L	Total C conc in water column ng/L	C benthic ng/kg	D water ng/L	measured D, ss, ng/kg	est. D conc.of ss ng/kg	Conc of ss D in water column ng/L	Total D conc in water column ng/L	D benthic ng/kg
Sep b-02													
SAL-DAV	18.2	54	870502	866041	16	70	50420	86	8897509	8890415	162	248	30443
SAL-MON	9.2	53	0	0	0	53	8868	203	302039	296647	3	206	1943
BLA-COO	81.7	51	0	0	0	51	20363	202	196559	183194	15	217	11663
BLA-PUM	74.8	54	52983	52102	4	58	2811	372	240969	234905	18	390	2432
REC-JON	11.1	69	631198	629845	7	76	16083	262	1014682	1009561	11	274	20158
OLS-POT	80.9	44	17696	17032	1	45	5485	104	98445	96877	8	112	14737
MOS-SAN	127.1	56	21112	20263	3	59	1202	0	6554178	6554178	833	833	826
EP1-ROG	83.6	386	34341987	34336446	2869	3255	51902	17829	927366733	927110755	77471	95300	345998
EPL-EPL	821.8	58	846104	845068	694	753	0	81	15422138	15420686	12673	12754	3770
Oct-02													
SAL-DAV	17.3	55	26358	25032	0	56	47136	22	212636	212108	4	26	44007
SAL-MON	162.0	55	0	0	0	55	6914	27	1181311	1180461	191	218	1685
BLA-COO	45.1	61	53162	51354	2	64	3222	50	525795	524327	24	73	4736
BLA-PUM	37.4	58	0	0	0	58	0	53	2519568	2518442	94	147	1701
REC-JON	22.3	111	771097	766337	17	128	147715	309	1428675	1415393	32	340	103097
OLS-POT	107.9	72	474212	469457	51	122	0	71	3914845	3910106	422	493	8439
MOS-SAN	146.8	91	16527	14739	2	94	0	25	142531	142041	21	46	1477
EP1-ROG	375.6	294	10790019	10786652	4051	4345	118000	2434	587827635	587799735	220769	223203	320406
EPL-EPL	566.3	87	0	0	0	87	0	36	1559150	1558102	882	918	2835
Means:													
SAL-DAV	16	67	202189	199881	3	71	37273	114	3427407	3421060	57	171	24759
SAL-MON	54	55	114096	111562	5	75	8534	93	1101149	1098838	73	166	2665
BLA-COO	64	58	46232	44891	2	59	75150	173	577606	570654	20	189	7576
BLA-PUM	45	56	18301	17949	1	57	1743	508	2062795	2054556	81	589	3488
REC-JON	38	82	1090564	1088366	37	119	216065	627	1079051	1062885	39	666	122550
OLS-POT	89	69	110336	108602	11	80	2904	109	1015594	1013361	100	209	13338
MOS-SAN	131	74	16482	15493	2	76	1057	26	1684191	1683767	215	241	1206
EP1-ROG	406	356	22901994	22899009	7132	7488	119789	20704	611552303	611440780	254317	275022	471608
EPL-EPL	746	69	187393	186711	149	218	1011	63	3704043	3702802	2915	2978	3834

Appendix 1, Table 4. Data of depth profiles performed during the July and October ambient sampling runs taken with a multi-probe data logger system for each site

July 2002 sampling run

Site	Depth (m)	Temp ©	SpCond	DO Conc (mg/L)	pH	pHmV	ORP	BP	Cond	DO %	Resistivit	Salinity	TDS (g/L)
SAL-DAV	0	17.68	0.47	5.95	7.83	-62.0	41	14.75	0.41	62.5	2.47	0.23	0.31
SAL-DAV	0.5	17.67	0.47	6.12	7.74	-57.5	44	14.76	0.41	64.3	2.47	0.23	0.31
SAL-DAV	1	17.68	0.47	6.18	7.73	-56.9	45	14.75	0.41	64.9	2.47	0.23	0.31
SAL-DAV	1.5	17.68	0.47	6.23	7.80	-60.8	45	14.76	0.41	65.5	2.47	0.23	0.31
SAL-DAV	2	17.67	0.47	6.23	7.78	-59.4	45	14.76	0.41	65.5	2.46	0.23	0.31
SAL-DAV	2.5	17.67	0.47	6.17	7.79	-60.0	46	14.76	0.41	64.8	2.47	0.23	0.31
SAL-MON	0	19.06	0.06	9.90	8.07	-75.7	-86	14.76	0.05	106.8	18.93	0.03	0.04
SAL-MON	0.5	22.27	1.57	8.43	8.74	-113.3	-112	14.76	1.49	97.4	0.67	0.79	1.02
SAL-MON	1	22.25	1.58	8.62	8.80	-116.2	-111	14.76	1.50	99.5	0.67	0.80	1.03
SAL-MON	1.5	22.23	1.60	8.59	8.79	-115.6	-109	14.76	1.51	99.1	0.66	0.81	1.04
BLA-COO	0	17.90	2.64	6.09	7.81	-61.3	74	14.83	2.28	64.7	0.44	1.37	1.71
BLA-COO	0.5	17.72	2.64	5.77	7.77	-58.7	75	14.86	2.27	61.1	0.44	1.37	1.72
BLA-PUM	0	20.44	2.63	10.35	8.27	-86.5	65	14.78	2.40	115.7	0.42	1.36	1.71
BLA-PUM	0.5	18.97	2.59	8.08	8.18	-81.3	64	14.77	2.29	87.7	0.44	1.34	1.68
BLA-PUM	1	18.86	2.60	7.57	8.11	-77.8	63	14.77	2.29	82	0.44	1.35	1.69
REC-JON	0	21.84	1.36	17.32	9.15	-135.3	5	14.73	1.27	198.2	0.78	0.68	0.88
OLS-POT	0	21.82	8.80	21.31	9.02	-128.0	-163	14.79	8.27	250.0	0.12	4.92	5.72
OLS-POT	0.5	18.17	33.29	13.51	8.43	-95.0	-153	14.81	28.95	162.3	0.03	20.90	21.64
MOS-SAN	0	14.54	48.62	5.46	7.99	-70.0	43	14.73	38.90	65.2	0.03	31.74	31.60
MOS-SAN	0.5	14.11	48.94	5.38	7.94	-67.5	43	14.73	38.76	63.8	0.03	31.96	31.81
EP1-ROG	0	28.36	1.42	6.90	8.31	-90.6	20	14.82	1.51	89.1	0.66	0.71	0.92
EPL-EPL	0	29.41	5.22	21.17	9.79	-174.6	-53	14.79	5.66	281.4	0.18	2.79	3.39

October 2002 sampling run

SAL-DAV	0	16.74	1.69	10.87	7.83	-67.5	47		1.42	112.4	0.70	0.86	1.10
SAL-DAV	0.5	16.75	1.69	10.99	7.84	-68.2	46		1.42	113.7	0.70	0.86	1.10
SAL-DAV	1	16.74	1.69	10.96	7.83	-67.7	46		1.42	113.4	0.70	0.86	1.10
SAL-DAV	1.5	16.61	1.70	10.83	7.83	-67.7	46		1.43	111.8	0.70	0.86	1.10
SAL-DAV	2	16.43	1.71	10.51	7.82	-66.9	46		1.43	108.0	0.70	0.87	1.11
SAL-DAV	2.5	16.33	1.71	10.06	7.77	-64.3	35		1.43	103.2	0.70	0.87	1.11
SAL-MON	0	15.87	1.24	8.61	8.28	-92.2	-5		1.03	87.3	0.98	0.62	0.81
SAL-MON	0.5	15.88	1.24	8.67	8.36	-97.0	-5		1.03	88.0	0.97	0.62	0.81
SAL-MON	0.75	15.89	1.24	8.85	8.40	-99.0	-5		1.03	89.7	0.97	0.62	0.81
BLA-COO	0	14.13	2.75	5.41	7.81	-66.0	12		2.18	53.1	0.46	1.44	1.79
BLA-PUM	0	15.24	2.44	6.31	8.09	-81.4	21		1.99	63.4	0.50	1.27	1.59
BLA-PUM	0.5	15.22	2.44	6.95	8.25	-90.8	14		1.99	69.7	0.50	1.27	1.59
BLA-PUM	0.75	15.42	2.49	7.25	8.22	-89.2	12		2.03	73.1	0.49	1.29	1.62
REC-JON	0	14.52	1.43	5.47	7.97	-74.9	8		1.15	53.9	0.87	0.72	0.93
OLS-POT	0	14.60	9.28	8.49	8.16	-85.2	3		7.43	86.1	0.13	5.23	6.03
OLS-POT	0.5	15.11	32.73	8.08	7.92	-71.9	6		26.55	91.1	0.04	20.51	21.28
OLS-POT	0.75	15.10	38.84	7.28	7.89	-70.8	4		31.50	84.2	0.03	24.75	25.24
MOS-SAN	0	14.91	42.79	6.23	7.65	-57.5	6		34.55	73.0	0.03	27.55	27.82
MOS-SAN	0.5	14.89	42.89	5.93	7.72	-61.0	4		34.61	69.5	0.03	27.63	27.88
MOS-SAN	1	14.89	42.93	6.16	7.72	-61.4	3		34.64	72.2	0.03	27.66	27.91
EP1-ROG	0	17.71	1.06	8.66	8.28	-92.8	-1		0.91	91.3	1.10	0.53	0.69
EPL-EPL	0	14.97	4.53	12.98	8.54	-106.8	12		3.66	130.6	0.27	2.43	2.94
EPL-EPL	0.3	15.00	4.52	11.07	8.54	-106.3	15		3.66	111.4	0.27	2.43	2.94

Appendix 1, Table 5. Summary of load calculations of chlorpyrifos and diazinon for the summer 2002 ambient monitoring period.

Data is based on discharge and concentration values in Table 4 (Q, discharge; C, chlorpyrifos; ss, suspended solids; D, diazinon; n/a, not available)

		Instantaneous loads							Total loads					
Site	**Q (L/sec)**	**C water g/day**	**C ss g/day**	**C water+ss g/day**	**D water g/day**	**D ss g/day**	**D water+ss g/day**	**days of load**	**C water kg**	**C ss kg**	**C water+ss kg**	**D water kg**	**D ss kg**	**D water+ss kg**
Jul-02								26						
SAL-DAV	121.4	1.1	0.0	1.1	0.5	0.8	1.2		0.03	0.00	0.03	0.01	0.02	0.03
SAL-MON	n/a													
BLA-COO	66.7	0.4	0.0	0.4	0.4	0.0	0.4		0.01	0.00	0.01	0.01	0.00	0.01
BLA-PUM	49.5	0.3	0.0	0.3	0.5	0.0	0.5		0.01	0.00	0.01	0.01	0.00	0.01
REC-JON	41.7	0.3	0.3	0.6	0.9	0.4	1.3		0.01	0.01	0.01	0.02	0.01	0.03
OLS-POT	n/a													
MOS-SAN	n/a													
EP1-ROG	27.4	0.3	2.4	2.7	159.1	1595.9	1755.0		0.01	0.06	0.07	4.14	41.49	45.63
EPL-EPL	n/a													
Aug-02								33.5						
SAL-DAV	n/a													
SAL-MON	n/a													
BLA-COO	53.8	0.3	0.0	0.3	0.5	0.2	0.6		0.01	0.00	0.01	0.01	0.00	0.02
BLA-PUM	49.5													
REC-JON	43.5	0.3	0.2	0.5	2.6	0.1	2.7		0.01	0.01	0.01	0.07	0.00	0.07
OLS-POT	n/a													
MOS-SAN	n/a													
EP1-ROG	18.9	0.2	0.2	0.4	5.9	31.9	37.8		0.01	0.00	0.01	0.15	0.83	0.98
EPL-EPL	n/a													
Sep a-02								13.5						
SAL-DAV	264.1	1.7	0.0	1.7	8.8	0.5	9.3		0.05	0.00	0.05	0.23	0.01	0.24
SAL-MON	n/a													
BLA-COO	77.0	0.4	0.0	0.4	3.0	0.0	3.0		0.01	0.00	0.01	0.08	0.00	0.08
BLA-PUM	49.5	0.2	0.0	0.2	0.5	0.0	0.6		0.01	0.00	0.01	0.01	0.00	0.01
REC-JON	38.3	0.2	0.1	0.3	5.4	0.1	5.4		0.01	0.00	0.01	0.14	0.00	0.14
OLS-POT	n/a													
MOS-SAN	n/a													
EP1-ROG	20.3	1.5	48.3	49.8	21.7	488.9	510.6		0.04	1.26	1.29	0.56	12.71	13.28
EPL-EPL	n/a													
Sep b-02								19.5						
SAL-DAV	n/a													
SAL-MON	n/a													
BLA-COO	47.8	0.2	0.0	0.2	0.8	0.1	0.9		0.01	0.00	0.01	0.02	0.00	0.02
BLA-PUM	49.5	0.2	0.0	0.2	8.0	1.2	9.2		0.01	0.00	0.01	0.21	0.03	0.24
REC-JON	38.3	0.2	0.0	0.3	0.9	0.0	0.9		0.01	0.00	0.01	0.02	0.00	0.02
OLS-POT	n/a													
MOS-SAN	n/a													
EP1-ROG	11.4	0.4	2.8	3.2	17.5	76.1	93.6		0.01	0.07	0.08	0.46	1.98	2.43
EPL-EPL	n/a													
Oct-02								21						
SAL-DAV	n/a													
SAL-MON	n/a													
BLA-COO	3.7	0.0	0.0	0.0	0.0	0.0	0.0		0.00	0.00	0.00	0.00	0.00	0.00
BLA-PUM	49.5	0.2	0.0	0.2	0.2	0.4	0.6		0.01	0.00	0.01	0.01	0.01	0.02
REC-JON	61.3	0.6	0.1	0.7	1.6	0.2	1.8		0.02	0.00	0.02	0.04	0.00	0.05
OLS-POT	n/a													
MOS-SAN	n/a													
EP1-ROG	24.6	0.6	8.6	9.2	5.2	469.3	474.5		0.02	0.22	0.24	0.13	12.20	12.34
EPL-EPL	n/a													

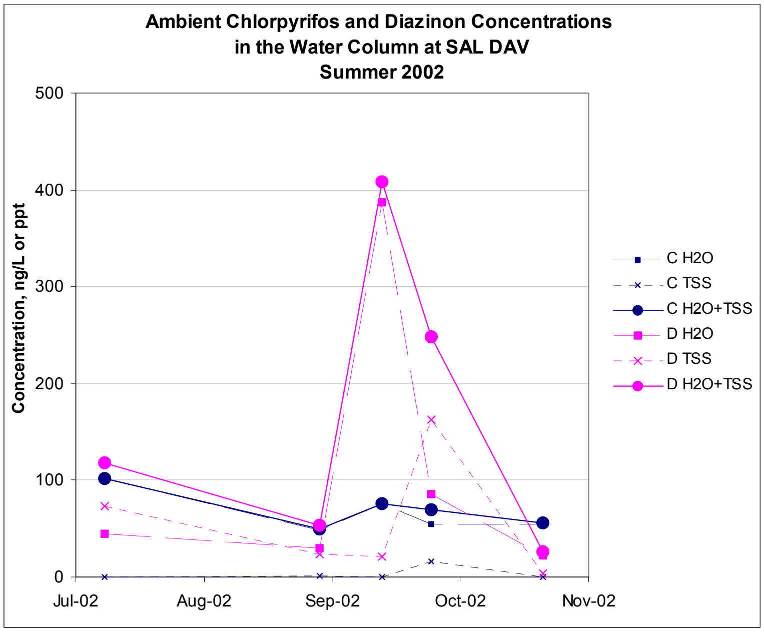

Figure 1. SAL-DAV water column concentrations of chlorpyrifos and diazinon

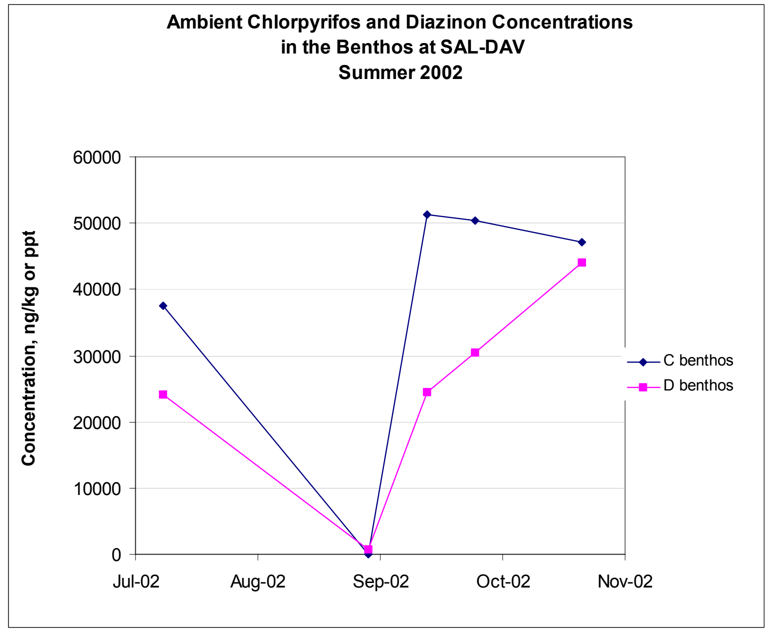

Figure 2. SAL-DAV benthic concentrations of chlorpyrifos and diazinon

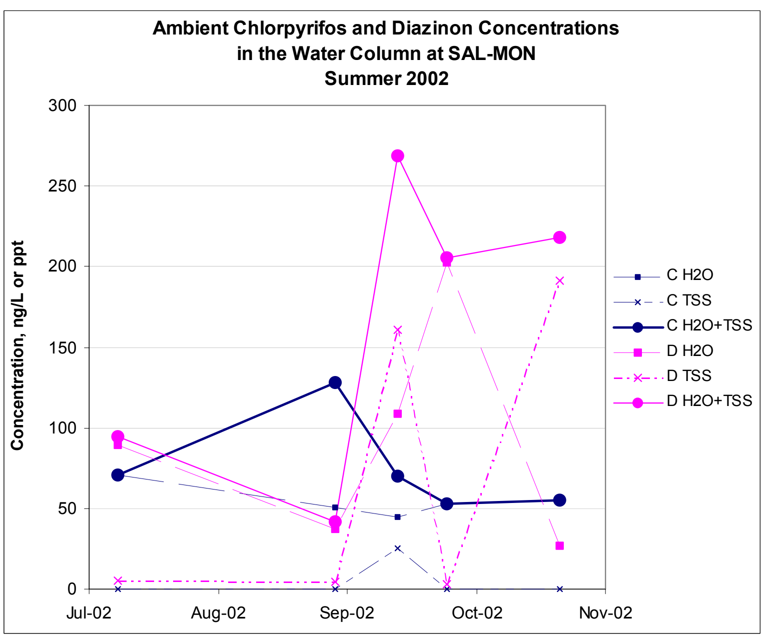

Figure 3. SAL-MON water column concentrations of chlorpyrifos and diazinon

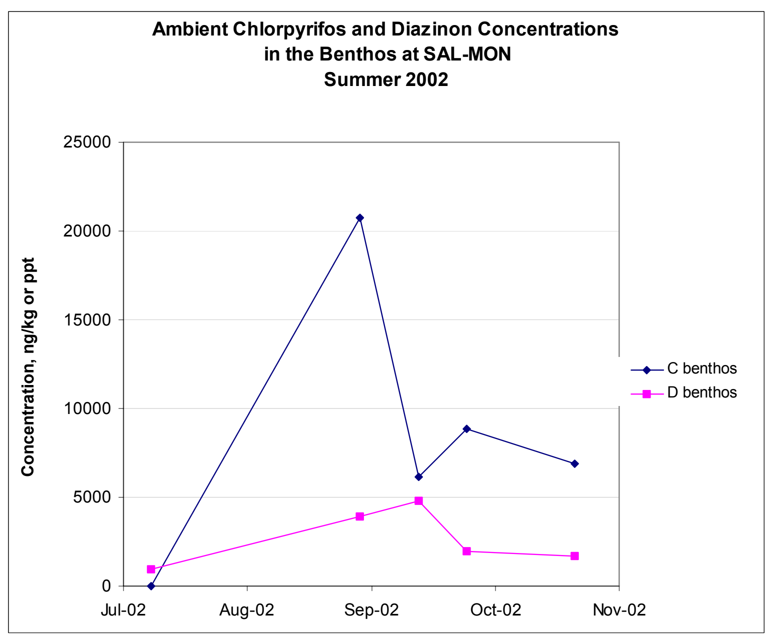

Figure 4. SAL-MON benthic concentrations of chlorpyrifos and diazinon

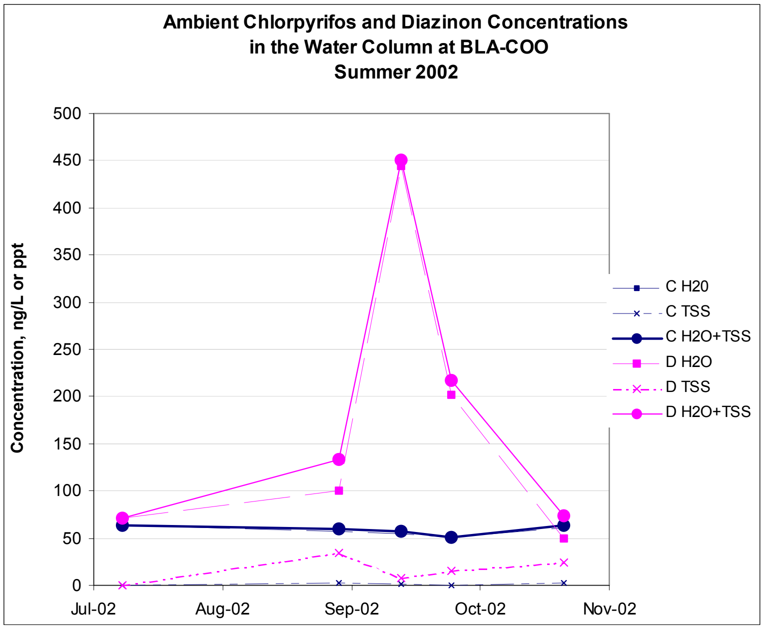

Figure 5. BLA-COO water column concentrations of chlorpyrifos and diazinon

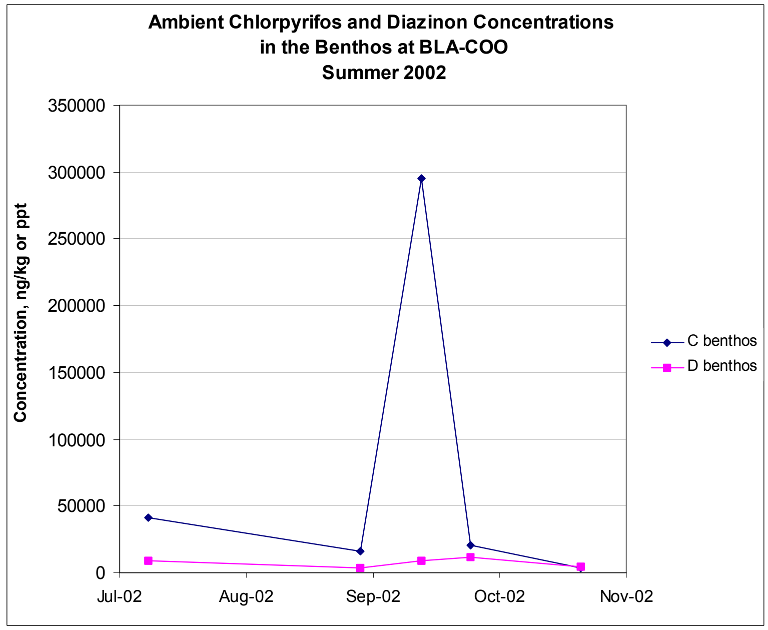

Figure 6. BLA-COO benthic concentrations of chlorpyrifos and diazinon

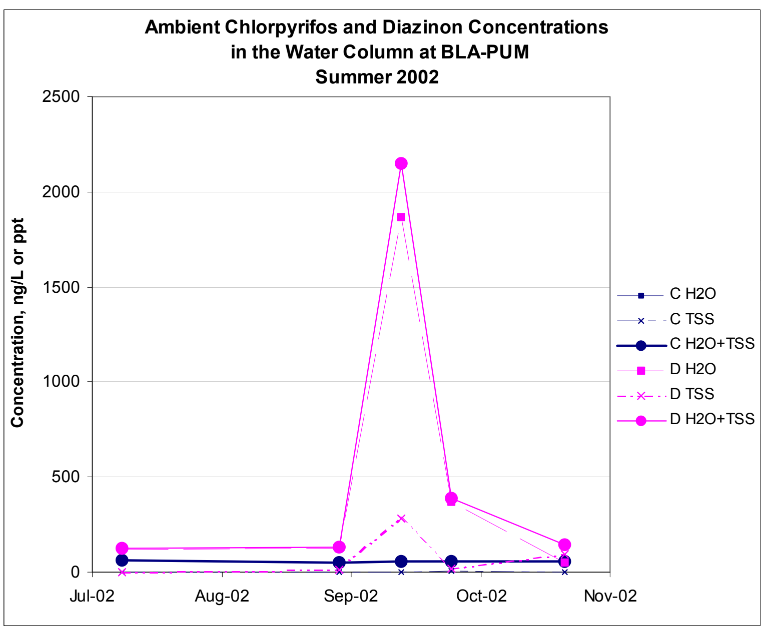

Figure 7. BLA-PUM water column concentrations of chlorpyrifos and diazinon

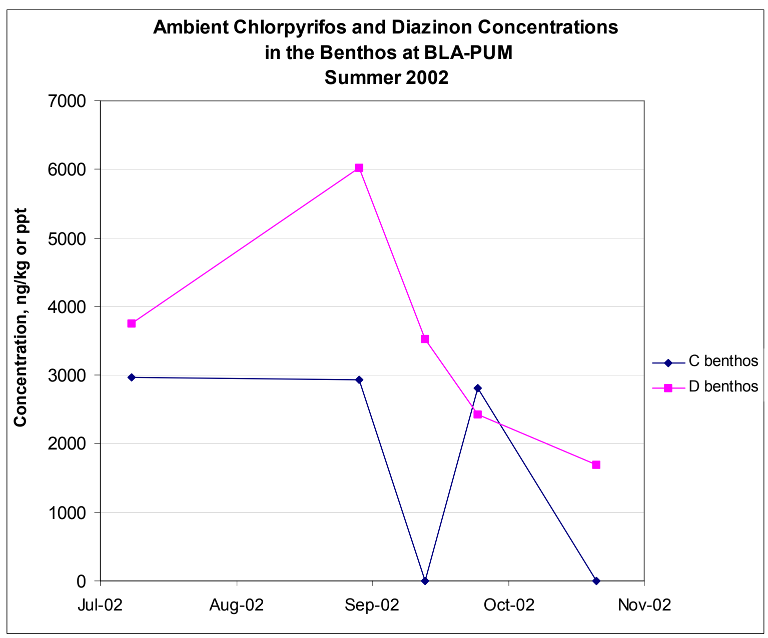

Figure 8. BLA-PUM benthic concentrations of chlorpyrifos and diazinon

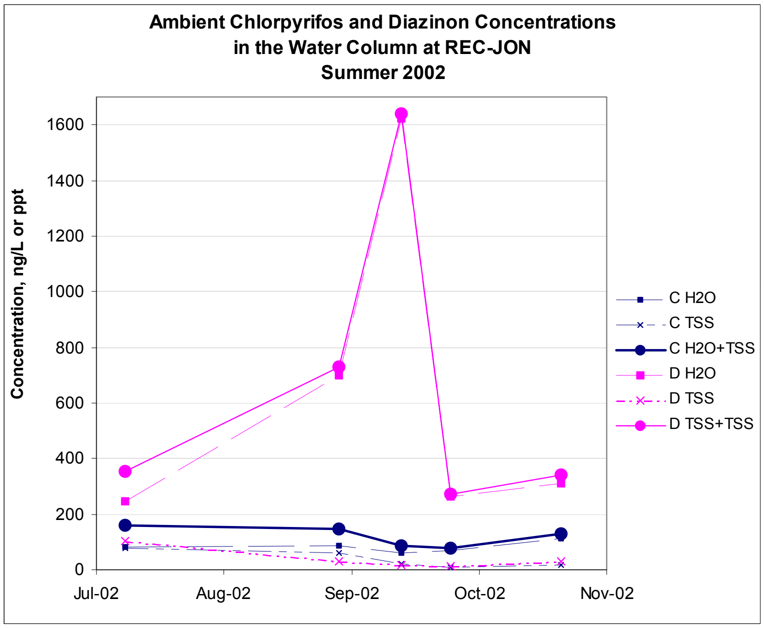

Figure 9. REC-JON water column concentrations of chlorpyrifos and diazinon

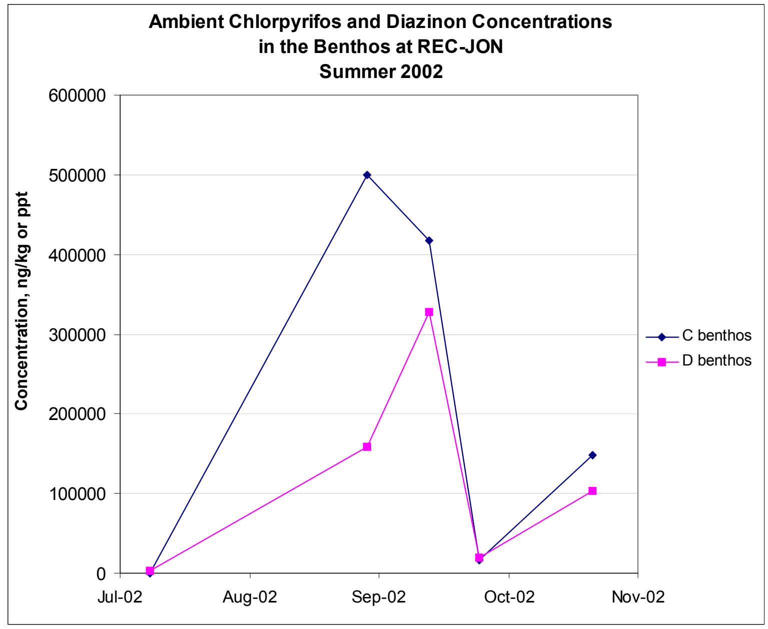

Figure 10. REC-JON benthic concentrations of chlorpyrifos and diazinon

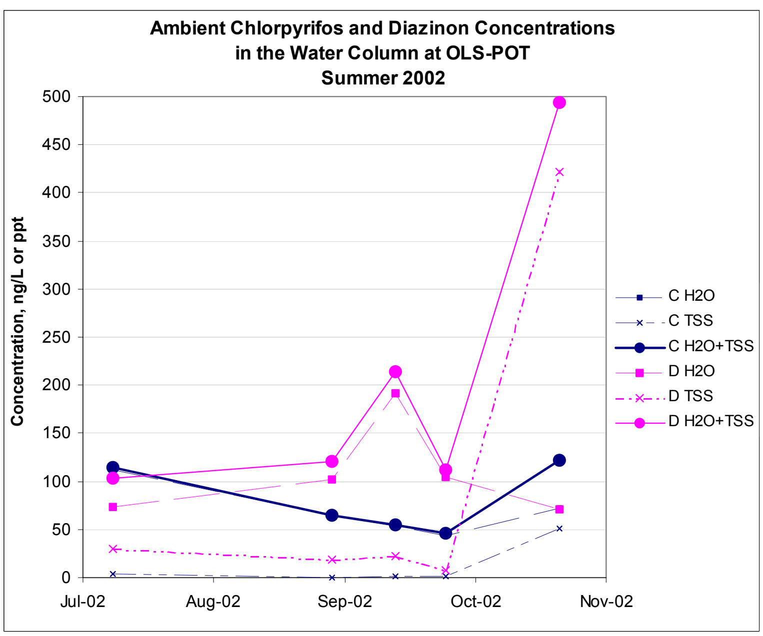

Figure 11. OLS-POT water column concentrations of chlorpyrifos and diazinon

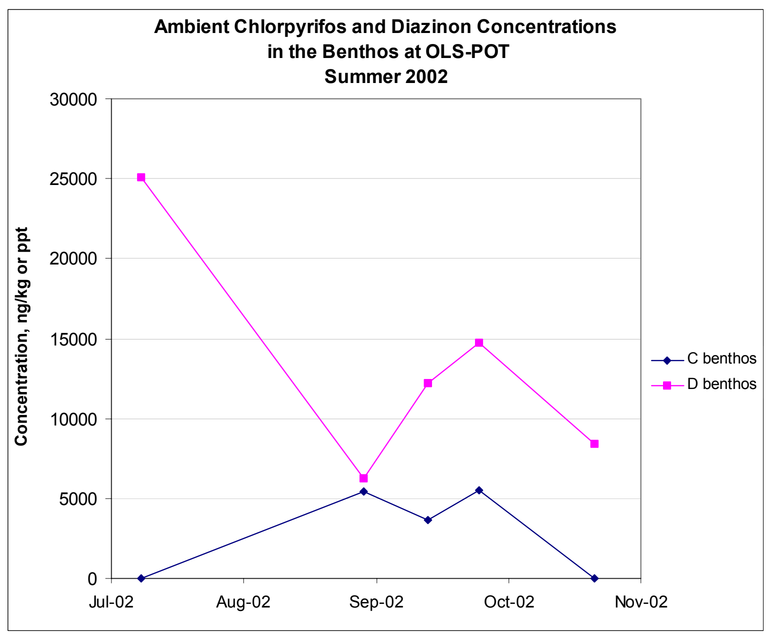

Figure 12. OLS-POT benthic concentrations of chlorpyrifos and diazinon

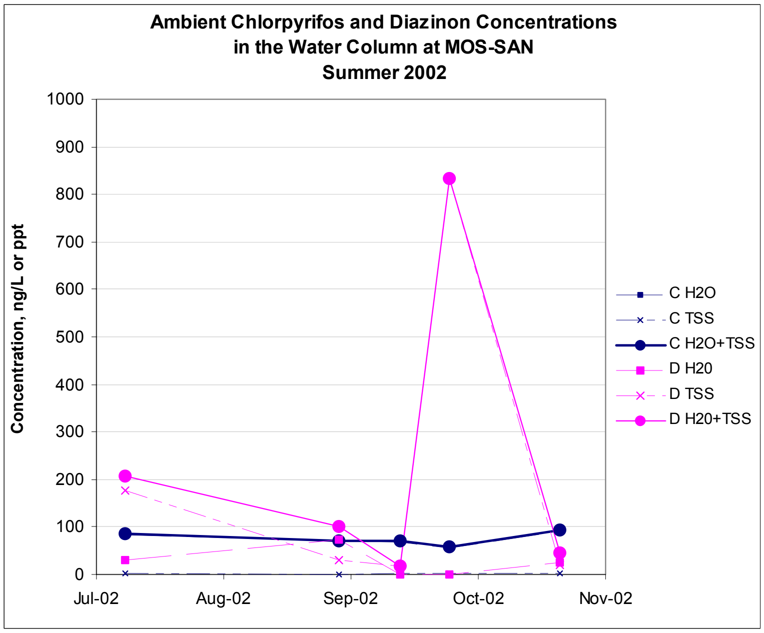

Figure 13. MOS-SAN water column concentrations of chlorpyrifos and diazinon

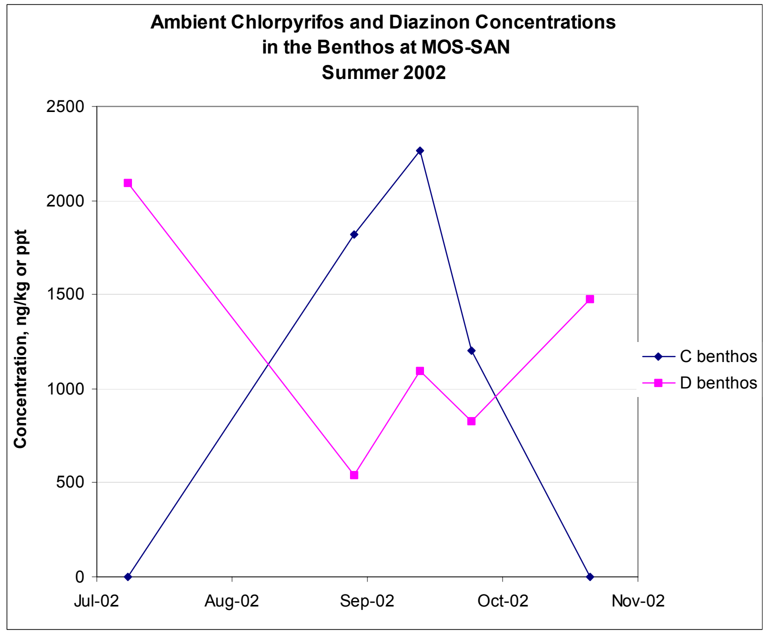

Figure 14. MOS-SAN benthic concentrations of chlorpyrifos and diazinon

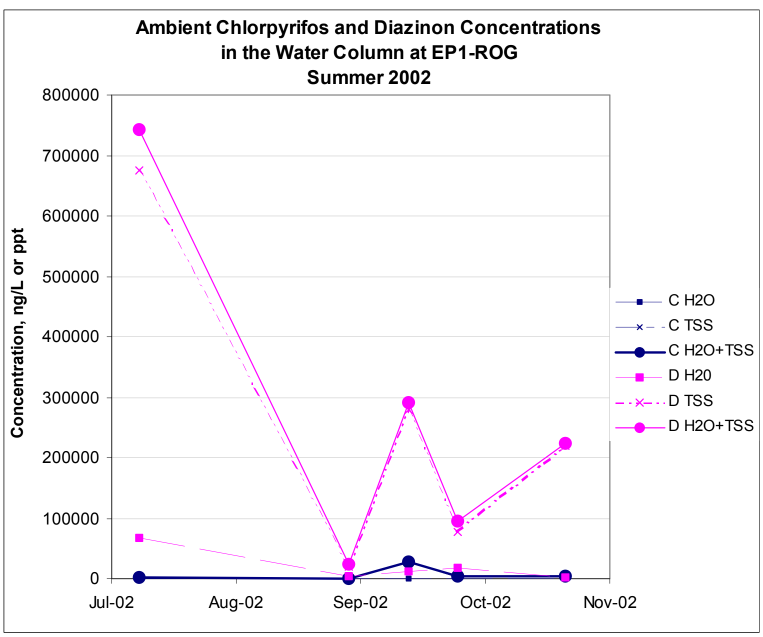

Figure 15. EP1-ROG water column concentrations of chlorpyrifos and diazinon

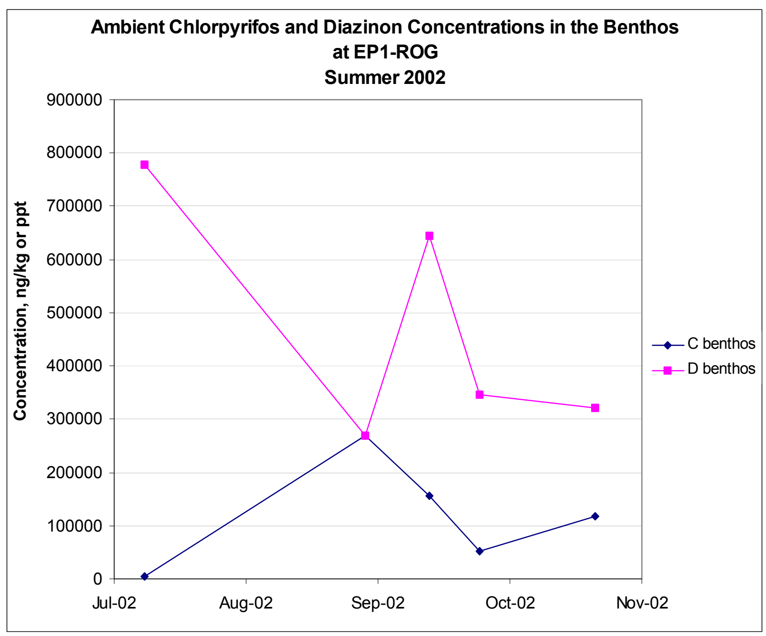

Figure 16. EP1-ROG benthic concentrations of chlorpyrifos and diazinon

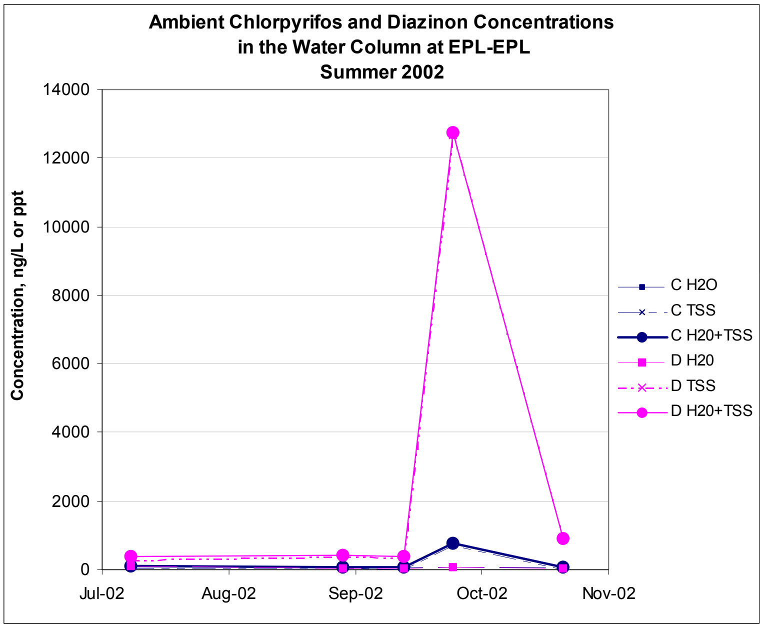

Figure 17. EPL-EPL water column concentrations of chlorpyrifos and diazinon

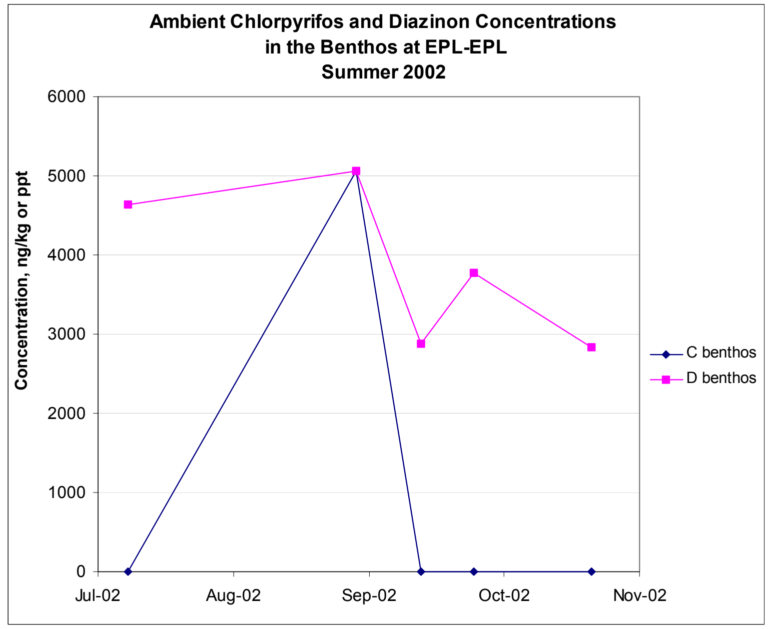

Figure 18. EPL-EPL benthic concentrations of chlorpyrifos and diazinon

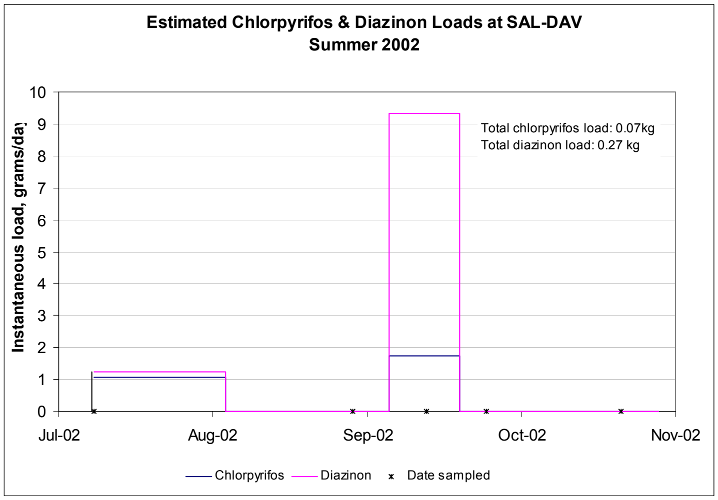

Figure 19. SAL-DAV estimated chlorpyrifos and diazinon loads.

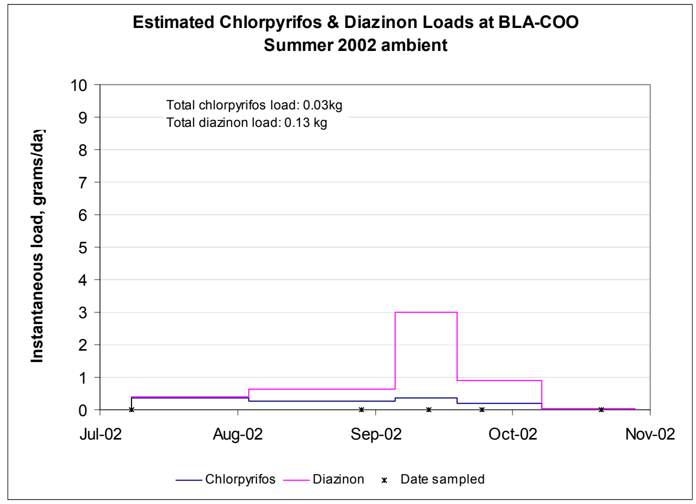

Figure 20. BLA-COO estimated chlorpyrifos and diazinon loads.

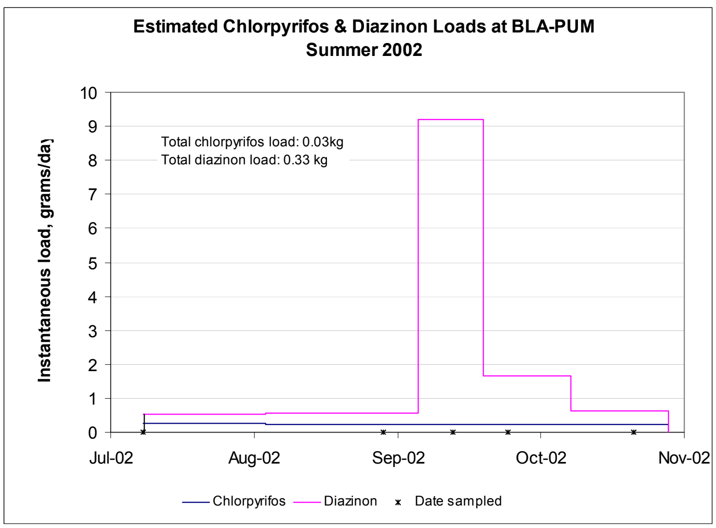

Figure 21. BLA-PUM estimated chlorpyrifos and diazinon loads.

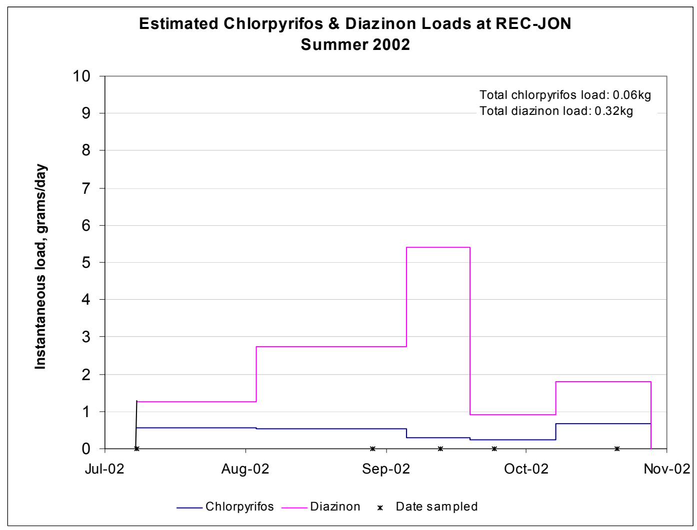

Figure 22. REC-JON estimated chlorpyrifos and diazinon loads.

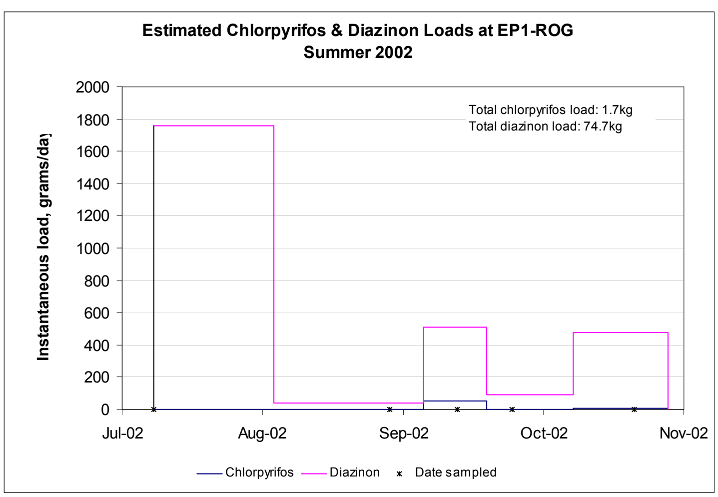

Figure 23. EP1-ROG estimated chlorpyrifos and diazinon loads.

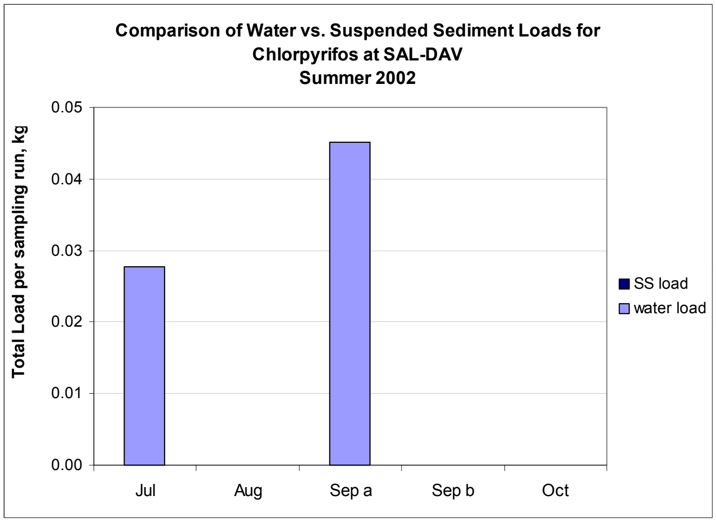

Figure 24. SAL-DAV chlorpyrifos water and suspended solids load comparisons.

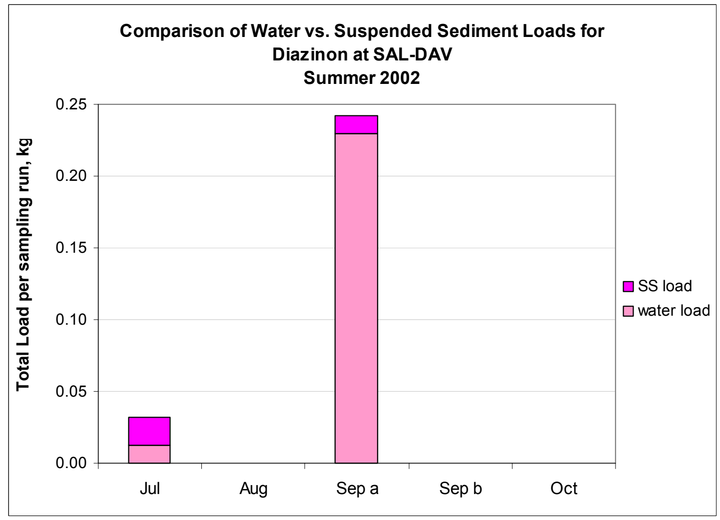

Figure 25. SAL-DAV diazinon water and suspended solids load comparisons.

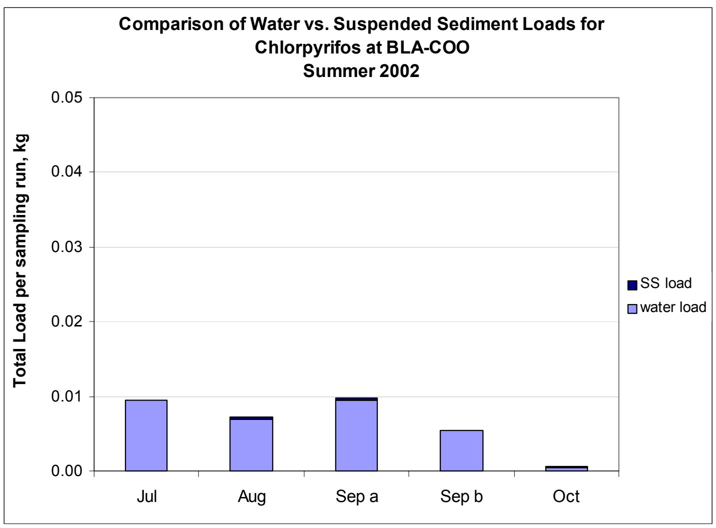

Figure 26. BLA-COO chlorpyrifos water and suspended solids load comparisons.

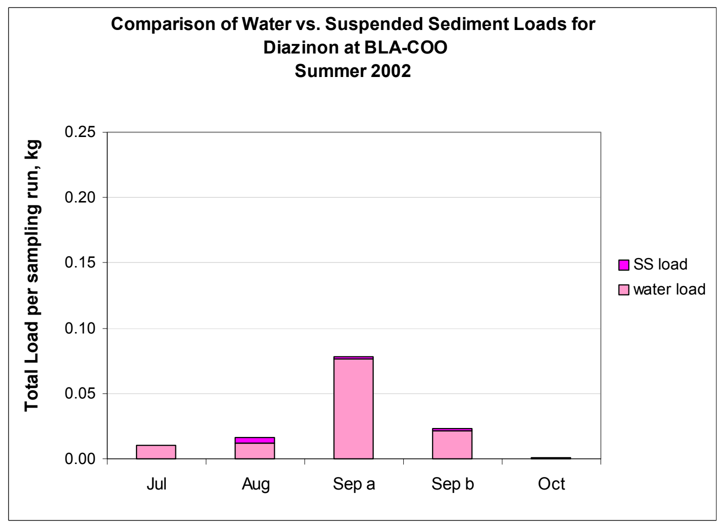

Figure 27. BLA-COO diazinon water and suspended solids load comparisons

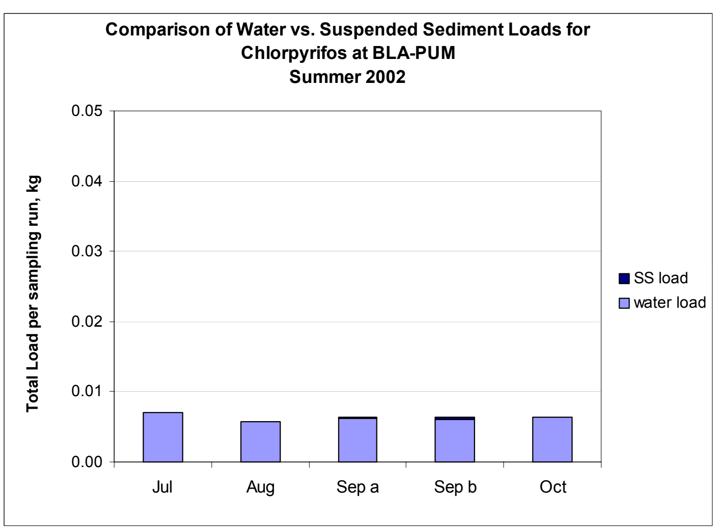

Figure 28. BLA-PUM chlorpyrifos water and suspended solids load comparisons

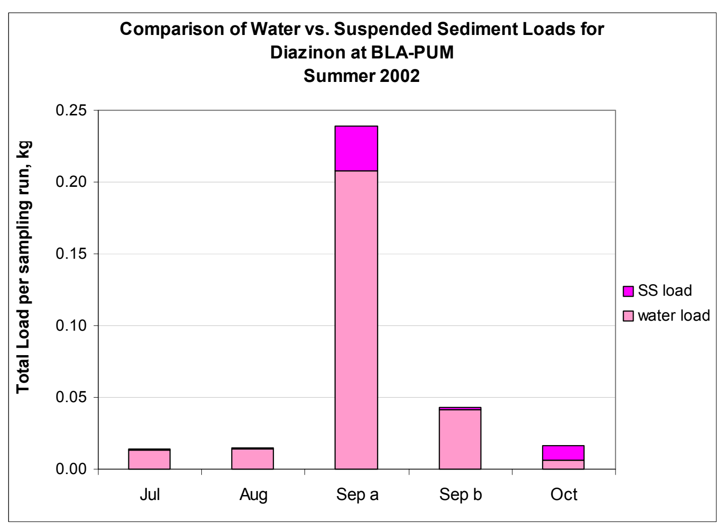

Figure 29. BLA-PUM diazinon water and suspended solids load comparisons

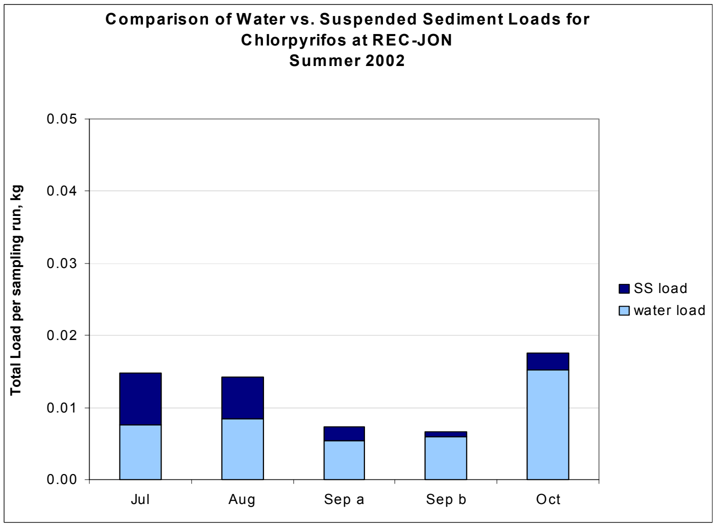

Figure 30. REC-JON chlorpyrifos water and suspended solids load comparisons

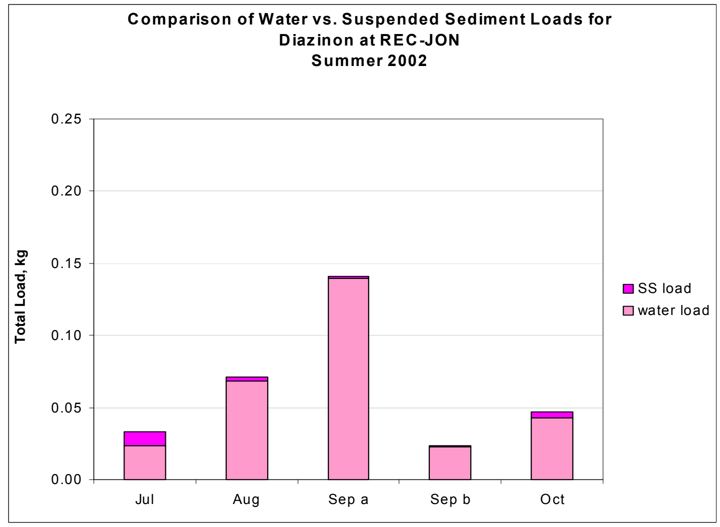

Figure 31. REC-JON diazinon water and suspended solids load comparisons

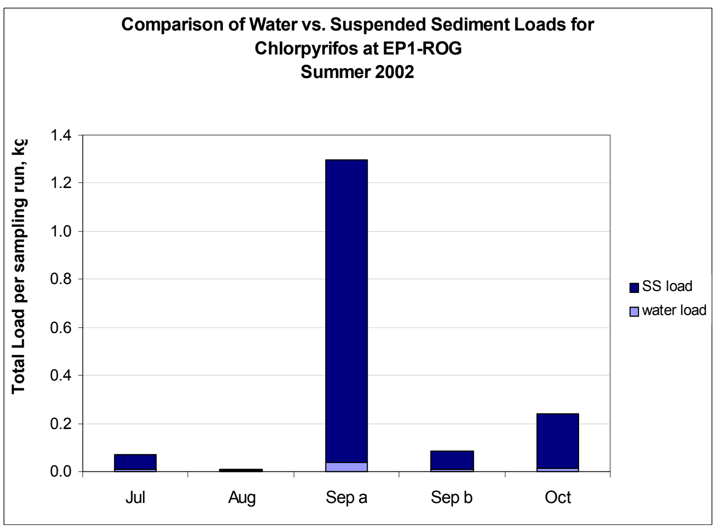

Figure 32. EP1-ROG chlorpyrifos water and suspended solids load comparisons

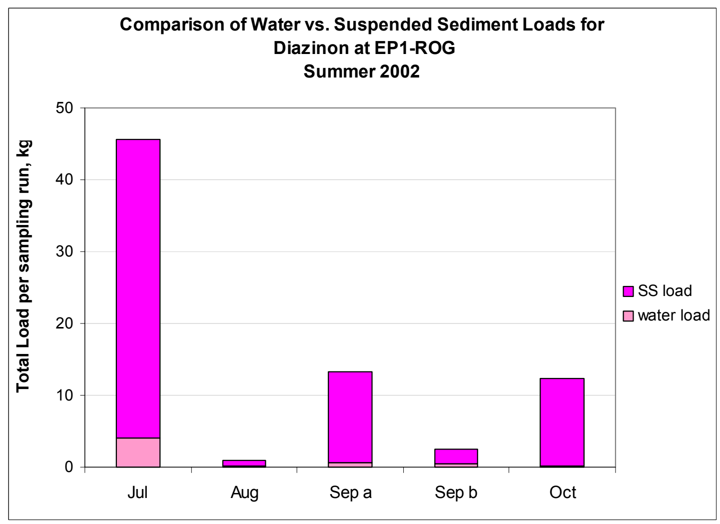

Figure 33. EP1-ROG diazinon water and suspended solids load comparisons

Appendix 2

Table 1. Quality Assurance/Quality Control Data

Table 2. Inter-Laboratory/Inter-Method Comparison Data

Reports 1 – 5. Agricultural & Priority Pollutants Laboratories, Inc. 8141A analysis of QA/QC samples submitted for each summer 2002 ambient run

Hardcopies submitted to DPR. No web versions created.

Appendix 2, Table 1. Quality Assurance/Quality Control Data

(Types: c, control; r, replicate; d, duplicate; sp, spike; fmb, field method blank; lmb, lab method blank. Matrix: w, water; m, methanol; b, benthic; ss, suspended sediment. Pesticide: c, chlorpyrifos; d, diazinon; ppt, parts per trillion; Flag: * value outside but within 10% of test range limits; CV, coefficient of variance; RPD, relative percent difference)

run	sample #	site	type	matrix	pesticide	value (ppt)	flag	CV of replicates (%)	RPD of duplicates	recovery of spikes (%)	R^2
DPRun_Jul2002											
2				w	c						98%
	control		c	w	c	824					
	228	sal-mon	r	w	c	68					
	228	sal-mon	r	w	c	69					
	228	sal-mon	r	w	c	75		5.3			
	228	sal-mon	sp	w	c	212				47.4	
	230	sal-dav	d	w	c	139					
	231	sal-dav	d	w	c	64			74.3		
	232	bla-coo	r	w	c	68					
	232	bla-coo	r	w	c	58	*	11.0			
	218		fmb	w	c	58	*				
4				m	c						98%
	control		c	m	c	910					
	209	ep1-rog	r	b	c	4096					
	209	ep1-rog	r	b	c	2924					
	209	ep1-rog	r	b	c	3586		16.6			
	209	ep1-rog	sp	b	c	19010				143.3	
	215	sal-dav	r	b	c	45901					
	215	sal-dav	r	b	c	29195		31.5			
	216	bla-coo	r	b	c	44746	*				
	216	bla-coo	r	b	c	37846		11.8			
			lmb	ss	c	nd	*				
5				m	c						96%
1				w	d						94%
	control		c	w	d	384					
	231	sal-dav	r	w	d	67					
	231	sal-dav	r	w	d	31		51.3			
	230	sal-dav	d	w	d	36			30.4		
	232	bla-coo	r	w	d	75					
	232	bla-coo	r	w	d	68		6.4			
	218		fmb	w	d	21	*				
	218		sp	w	d	104				51.6	
2				w	d						93%
	control		c	w	d	208					
	227	rec-jon	r	w	d	335					
	227	rec-jon	r	w	d	211					
	227	rec-jon	r	w	d	199		30.3			
3				w	d						100%
	control		c	w	d	286					
	221	rec-jon	r	w	d	26489	*				
	221	rec-jon	r	w	d	28540					
	221	rec-jon	r	w	d	54895					
	221	rec-jon	r	w	d	159016		93.0			
			lmb	w	d	nd	*				
4				m	d						92%
	202	sal-mon	r	b	d	1283					
	202	sal-mon	r	b	d	585	*	52.9			
	203	epl-epl	r	b	d	7603					
	203	epl-epl	r	b	d	2851					
	203	epl-epl	r	b	d	3463		55.7			
	203	epl-epl	sp	b	d	19314				119.0	

Appendix 2, Table 1. Quality Assurance/Quality Control Data (Cont.)

(Types: c, control; r, replicate; d, duplicate; sp, spike; fmb, field method blank; lmb, lab method blank. Matrix: w, water; m, methanol; b, benthic; ss, suspended sediment. Pesticide: c, chlorpyrifos; d, diazinon; ppt, parts per trillion; Flag: * value outside but within 10% of test range limits; CV, coefficient of variance; RPD, relative percent difference)

run	sample #	site	type	matrix	pesticide	value (ppt)	flag	CV of replicates (%)	RPD of duplicates	recovery of spikes (%)	R^2
	207	mos-san	r	b	d	2820					
	207	mos-san	r	b	d	1360		49.4			
	212	rec-jon	r	b	d	3875					
	212	rec-jon	r	b	d	1681		55.8			
	215	sal-dav	r	b	d	34508	*				
	215	sal-dav	r	b	d	13806		60.6			
	216	bla-coo	r	b	d	11970					
	216	bla-coo	r	b	d	6108		45.9			
			lmb	ss	d	nd	*				
5				m	d						97%
6				m	d						97%
7											99%
	208	ep1-rog	r	ss	d	535744659					
	208	ep1-rog	r	ss	d	717992060		20.6			
	201	sal-mon	r	ss	d	221646					
	201	sal-mon	r	ss	d	75250	*	69.7			
DPRun_Aug2002											
1				w	c						99%
	control		c	w	c	706					
	22	sal-mon	r	w	c	53	*				
	22	sal-mon	r	w	c	48	*	6.1			
	22	sal-mon	sp	w	c	284				75.2	
	19		fmb-b	w	c	nd	*				
	15		fmb-w	w	c	nd	*				
2				m	c						96%
	control		c	m	c	626					
	49	sal-mon	d	b	c	8524					
	43	sal-mon	r	b	c	19935					
	43	sal-mon	r	b	c	21587					
	43	sal-mon	r	b	c	24073					
	43	sal-mon	r	b	c	20102		8.9			
	43sp	sal-mon	sp	b	c	30187				81.8	
	34		fmb	ss	c	nd	*				
	34		fmb	ss	c	nd	*				
3				m	c						97%
4				m	c						96%
1				w	d						98%
	control		c	w	d	348					
	22	sal-mon	r	w	d	31					
	22	sal-mon	r	w	d	26	*	11.6			
	7	sal-mon	d	w	d	26	*		9.8		
	22	sal-mon	sp	w	d	67				35.8	
	15		fmb-w	w	d	38					
	19		fmb-b	w	d	66					
2				w	d						98%
	6	ep1-rod	r	w	d	3519					
	6	ep1-rod	r	w	d	3692		3.4			
3				m	d						98%
	control		c	m	d	1976					
	49	sal-mon	d	b	d	8317			46.1		
	43	sal-mon	r	b	d	5121					
	43	sal-mon	r	b	d	5284		2.2			

Appendix 2, Table 1. Quality Assurance/Quality Control Data (Cont.)

(Types: c, control; r, replicate; d, duplicate; sp, spike; fmb, field method blank; lmb, lab method blank. Matrix: w, water; m, methanol; b, benthic; ss, suspended sediment. Pesticide: c, chlorpyrifos; d, diazinon; ppt, parts per trillion; Flag: * value outside but within 10% of test range limits; CV, coefficient of variance; RPD, relative percent difference)

run	sample #	site	type	matrix	pesticide	value (ppt)	flag	CV of replicates (%)	RPD of duplicates	recovery of spikes (%)	R^2
	34		fmb	ss	d	5066	*				
4					d						99%
	control		c	m	d	322					
	49	sal-mon	d	b	d	8110			89.1		
	43	sal-mon	r	b	d	3612					
	43	sal-mon	r	b	d	2619					
	43	sal-mon	r	b	d	3099		16.0			
	43	sal-mon	sp,r	b	d	11032				61.9	
	43	sal-mon	sp,r	b	d	7412		27.8			
	34		fmb	ss	d	6612					
	34		fmb	ss	d	6765					
5				m	d						95%
	control		c	m	d	22					
	25	ep1-rod	r	b	d	244341					
	25	ep1-rod	r	b	d	258393					
	25	ep1-rod	r	b	d	302752		11.4			
DPRun_Sep2002a											
1				w	c						100%
	control		c	w	c	711					
	219	bla-coo	s	w	c	62					
	219	bla-coo	sp	w	c	226				58.3	
	230	bla-coo	d	w	c	48	*	24.9			
	221		fmb	b	c	51	*				
	228		fmb	w	c	nd	*				
2				m	c						96%
	control		c	m	c	621					
	210	bla-coo	r	ss	c	23576	*				
	210	bla-coo	r	ss	c	23838	*	0.8			
	210	bla-coo	sp	ss	c	142547					
	202	bla-coo	d	b	c	34770		37.8		72.1	
	209		fmb	ss	c	nd	*				
	209		fmb	ss	c	nd	*				
3				m	c						96%
	217	ep1-rog	r	b	c	177502					
	217	ep1-rog	r	b	c	136521	*	18.5			
4				m	c						93%
	211	ep1-rog	r	ss	c	77348539					
	211	ep1-rog	r	ss	c	73198896					
	211	ep1-rog	r	ss	c	51355360	*	20.7			
	214	bla-coo	r	b	c	410437					
	214	bla-coo	r	b	c	439770	*	4.9			
1				w	d						97%
	control			w	d	366					
	230	bla-coo	d	w	d	461	*		5.2		
	219	bla-coo	r	w	d	434					
	219	bla-coo	r	w	d	449	*				
	219	bla-coo	r	w	d	431		2.2			
	219	bla-coo	sp	w	d	287				71.3	
	228		fmb	w	d	24	*				
	221		fmb	b	d	30					
2				w	d						97%
	232	rec-jon	r	w	d	669					

Appendix 2, Table 1. Quality Assurance/Quality Control Data (Cont.)

(Types: c, control; r, replicate; d, duplicate; sp, spike; fmb, field method blank; lmb, lab method blank. Matrix: w, water; m, methanol; b, benthic; ss, suspended sediment. Pesticide: c, chlorpyrifos; d, diazinon; ppt, parts per trillion; Flag: * value outside but within 10% of test range limits; CV, coefficient of variance; RPD, relative percent difference)

run	sample #	site	type	matrix	pesticide	value (ppt)	flag	CV of replicates (%)	RPD of duplicates	recovery of spikes (%)	R^2
	232	rec-jon	r	w	d	2571	*	83.0			
	223	bla-pum	r	w	d	940					
	223	bla-pum	r	w	d	2799		70.3			
3				m	d						97%
	control		c	m	d	173					
	210	bla-coo	r	ss	d	113128					
	210	bla-coo	r	ss	d	123668		6.3			
	214	bla-coo	r	b	d	9260					
	214	bla-coo	r	b	d	8547					
	214	bla-coo	r	b	d	8509		4.8			
	214	bla-coo	sp	b	d	10259				112.2	
	202	bla-coo	d	b	d	10122			14.3		
	52		r		d	393947	*				
	52		r		d	333535		11.7			
	209		fmb	ss	d	1365					
4				m	d						99%
	control		c	m	d	233					
	203	bla-pum	r	ss	d	6736812					
	203	bla-pum	r	ss	d	7505961	*	7.6			
	217	ep1-rog	r	b	d	624702					
	217	ep1-rog	r	b	d	663940	*	4.3			
	31	rec-jon	r	b	d	346935	*				
	31	rec-jon	r	b	d	308191					
	31	rec-jon	r	b	d	10219038		157.6			
	206	sal-dav	r	ss	d	1243842					
	206	sal-dav	r	ss	d	2721479	*	52.7			
	29	ols-pot	r	ss	d	263747					
	29	ols-pot	r	ss	d	776874	*	69.7			
5				m	d						98%
	211	ep1-rog	r	ss	d	713047471	*				
	211	ep1-rog	r	ss	d	698981271					
	211	ep1-rog	r	ss	d	631243012					
	211	ep1-rog	r	ss	d	680894990	*	5.2			
DPRun_Sep2002b											
1				w	c						99%
	control		c	w	c	814					
	100	bla-pum	r	w	c	60	*				
	100	bla-pum	r	w	c	61	*				
	100	bla-pum	r	w	c	47	*	14.0			
	100	bla-pum	sp	w	c	237				54.5	
	22	bla-pum	d	w	c	48	*		14.2		
	15		fmb	w	c	57	*				
	6		fmb	b	c	nd					
2				m	c						94%
	control		c	m	c	639					
	47	bla-pum	r	ss	c	56088					
	47	bla-pum	r	ss	c	57551					
	47	bla-pum	r	ss	c	45309		12.6			
	36	bla-pum	d	b	c	3718					
	54	bla-pum	r,d	b	c	2250	*		44.8		
	54	bla-pum	r,d	b	c	2466	*	6.5			
	54	bla-pum	sp	b	c	11609				61.9	

Appendix 2, Table 1. Quality Assurance/Quality Control Data (Cont.)

(Types: c, control; r, replicate; d, duplicate; sp, spike; fmb, field method blank; lmb, lab method blank. Matrix: w, water; m, methanol; b, benthic; ss, suspended sediment. Pesticide: c, chlorpyrifos; d, diazinon; ppt, parts per trillion; Flag: * value outside but within 10% of test range limits; CV, coefficient of variance; RPD, relative percent difference)

run	sample #	site	type	matrix	pesticide	value (ppt)	flag	CV of replicates (%)	RPD of duplicates	recovery of spikes (%)	R^2
5889	39		fmb	ss	c	6781					
	39		fmb	ss	c	4996					
3				m	c						99%
4				m	c						96%
	200	ep1-rog	r	ss	c	34449686					
	200	ep1-rog	r	ss	c	38869359					
	200	ep1-rog	r	ss	c	29706917		13.3			
1				w	d						99%
	control		c	w	d	359					
	100	bla-pum	r	w	d	394					
	100	bla-pum	r	w	d	453	*				
	100	bla-pum	r	w	d	434	*	7.1			
	100	bla-pum	sp	w	d	299				76.1	
	22	bla-pum	d	w	d	470	*		9.7		
	15		fmb	w	d	35					
	6		fmb	b	d	52					
2				w	d						98%
	226	ep1-rog	r	w	d	9581					
	226	ep1-rog	r	w	d	26078	*	65.4			
	100	bla-pum	r	w	d	318					
	100	bla-pum	r	w	d	272		11.0			
	22	bla-pum	d	w	d	264			11.2		
3				m	d						98%
	control		c	m	d	459					
	47	bla-pum	r	ss	d	210325					
	47	bla-pum	r	ss	d	250792	*				
	47	bla-pum	r	ss	d	261790	*	11.2			
	36	bla-pum	r,d	b	d	2722			37.8		
	36	bla-pum	r,d	b	d	3288		13.3			
	54	bla-pum	r,d	b	d	1807					
	54	bla-pum	r,d	b	d	2056					
	54	bla-pum	r,d	b	d	2289		11.7			
	54	bla-pum	sp	b	d	20121				73.8	
4				m	d						97%
	control		c	m	d	311					
	46	mos-san	r	ss	d	3077911					
	46	mos-san	r	ss	d	10030444	*	75.0			
	35	sal-dav	r	ss	d	9800390					
	35	sal-dav	r	ss	d	7994627		14.4			
	212	epl-epl	r	ss	d	14551257					
	212	epl-epl	r	ss	d	15297550	*				
	212	epl-epl	r	ss	d	16417607		6.1			
	30	rec-jon	r	ss	d	792213					
	30	rec-jon	r	ss	d	1237152	*	31.0			
	215	ep1-rog	r	b	d	312180					
	215	ep1-rog	r	b	d	553438	*				
	215	ep1-rog	r	b	d	172376		55.7			
	39		fmb	ss	d	169778					
	39		fmb	ss	d	163737	*				
5				m	d						97%
	200	ep1-rog	r	ss	d	451152771					
	200	ep1-rog	r	ss	d	598677608					

Appendix 2, Table 1. Quality Assurance/Quality Control Data (Cont.)

(Types: c, control; r, replicate; d, duplicate; sp, spike; fmb, field method blank; lmb, lab method blank. Matrix: w, water; m, methanol; b, benthic; ss, suspended sediment. Pesticide: c, chlorpyrifos; d, diazinon; ppt, parts per trillion; Flag: * value outside but within 10% of test range limits; CV, coefficient of variance; RPD, relative percent difference)

run	sample #	site	type	matrix	pesticide	value (ppt)	flag	CV of replicates (%)	RPD of duplicates	recovery of spikes (%)	R^2
	200	ep1-rog	r	ss	d	1732269822		75.6			
DPRun_Oct2002											
1				w	c						96%
	control		c	w	c	669					
	37	rec-jon	d	w	c	121			12.5		
	41	rec-jon	r	w	c	115					
	41	rec-jon	r	w	c	110					
	41	rec-jon	r	w	c	96		8.9			
	48	sal-mon	fmb-hc	w	c	63					
	45	ols-pot	fmb-hc	w	c	64					
2				m	c						98%
	control		c	m	c	740					
3				m	c						97%
	control		c	m	c	546					
			lmb	m	c	nd					
4				m	c						99%
1				w	d						96%
	control			w	d	361					
	37	rec-jon	d	w	d	344			14.6		
	41	rec-jon	r	w	d	296					
	41	rec-jon	r	w	d	297					
	41	rec-jon	r	w	d	298		0.5			
	48	sal-mon	fmb-hc	w	d	56					
	45	ols-pot	fmb-hc	w	d	18	*				
2				w	d						100%
	42	ep1-rog	r	w	d	1874					
	42	ep1-rog	r	w	d	2993					
	42	ep1-rog	r	w	d	15950	*	112.7			
	43	ep1-rog	r	w,ss	d	2188					
	43	ep1-rog	r	w,ss	d	2596					
	43	ep1-rog	r	w,ss	d	25077		131.6	35.7		
3				m	d						99%
	control		c	m	d	232					
4				m	d						96%
	244	rec-jon	d	b	d	126572	*		1.2		
	245	rec-jon	r	b	d	131132	*				
	245	rec-jon	r	b	d	129693	*				
	245	rec-jon	r	b	d	114236	*	7.5			
5				m	d						97%
	control		c	m	d	386					
	247	rec-jon	r	ss	d	1547865	*				
	247	rec-jon	r	ss	d	1564269	*				
	247	rec-jon	r	ss	d	1422676	*	5.1			
	247	rec-jon	sp	ss	d	1321469	*				
	247	rec-jon	sp,r	ss	d	1287096	*	1.9		7.37	
	lmb				d	nd					

Appendix 2, Table 1. Quality Assurance/Quality Control Data (Cont.)

(Types: c, control; r, replicate; d, duplicate; sp, spike; fmb, field method blank; lmb, lab method blank. Matrix: w, water; m, methanol; b, benthic; ss, suspended sediment. Pesticide: c, chlorpyrifos; d, diazinon; ppt, parts per trillion; Flag: * value outside but within 10% of test range limits; CV, coefficient of variance; RPD, relative percent difference)

run	sample #	site	type	matrix	pesticide	value (ppt)	flag	CV of replicates (%)	RPD of duplicates	recovery of spikes (%)	R^2
6				m	d						89%
	252	mos-san	r	ss	d	155427					
	252dl	mos-san	r	ss	d	129635		12.8			
	241	sal-dav	r	ss	d	206853					
	241dl	sal-dav	r	ss	d	218418		3.8			
	248	ep1-rog	r	ss	d	270207392					
	248	ep1-rog	r	ss	d	235968131					
	248	ep1-rog	r	ss	d	818463632					
	248	ep1-rog	r	ss	d	766773600					
	248	ep1-rog	r	ss	d	847725419		52.3			
	lmb				d	nd					

Appendix 2, Table 2. Inter-Laboratory/Inter-Method Comparison Data
(x, CCoWS value consistent with APPL; #, CCoWS value marginal; *, see notes; C, chlorpyrifos; D, diazinon)

run	site	Lab	C, water	%error	C, benthic	%error	D, water	%error	D, benthic	%error
Jul '02 ambient	sal-dav	CCoWS	102	x	37,548	-40	45	x	24,157	x
		APPL	<500		63,000		<500		<50,000	
Aug '02 ambient	sal-mon	CCoWS	50	#	20,735	x	37	x	3,947	x
		APPL	<50		<50,000		<50		<50,000	
Sep a '02 ambient	bla-coo	CCoWS	55	#	294,992	*	444	53	9,109	x
		APPL	<50		<50,000		290		<50,000	
Sep b '02 ambient	bla-pum	CCoWS	54	#	2,811	x	372	16	2,432	x
		APPL	<50		<50,000		320		<50,000	
Oct '02 ambient	rec-jon	CCoWS	111	177	147,715	48	309	23	103,097	72
		APPL	40		100,000		250		60,000	
Average				177		4		31		72

Notes: 1) APPL labs used a higher detection limit for water samples on the first run (500, not 50)
2) *, duplicate sample #202 value = 34,770, consistent with APPL labs. Duplicate sample #214 replicates averaged approximately 425,000. 3) Averages based on known values only.